futurefundi

NCV2 **Mathematics**

Memoranda

Question papers Maths L2

Introduction to Paper 1 and Paper 2

Proposed mark distribution between Paper 1 and Paper 2 for external examination papers

Paper 1	
Topics	**Marks**
1. Numbers	30
2. Functions and Algebra	
2.1 Functions	25
2.2 Algebra	25
5. Financial Mathematics	20
Total	**100**

Paper 2	
Topics	**Marks**
3. Space, Shape and Measurement	
3.1 Geometry	30
3.2 Trigonometry	30
4. Data Handling	40
Total	**100**

Chapter 1: **Numbers** (Paper 1)

QUESTION 1: Converting numbers

SOLUTION 1.1 1.1.1

Steps	Explanation
1.16	Identify the decimal as a terminating decimal and you need to convert it to a fraction.
$= \frac{1{,}16}{1}$	Express the decimal as a fraction and multiply the numerator and denominator by 100.
$= \frac{58}{100}$	Simplify the fraction.
$= \frac{29}{50}$	Simplify the fraction.

(1)

SOLUTION 1.1.2

Steps	Explanation
$0{,}3\dot{7}$	Identify the decimal as a recurring decimal and you need to convert it to a fraction.
Let $x = 0{,}3\dot{7}$	Let x be equal to the decimal.
$100x = 37{,}\dot{7}$ (A)	Multiply the decimal by 100 to form another decimal. Write as an equation.
$10x = 3{,}\dot{7}$ (B)	Multiply the decimal by 10 to form another decimal. Write as an equation.
$90x = 34$ (B) – (A)	Subtract the two equations.
$x = \frac{34}{90}$	Solve for x.
$x = \frac{17}{45}$	Simplify the fraction.

(2)

SOLUTION 1.2 1.2.1

Steps	Explanation
0,032	Identify the decimal as a terminating decimal and you need to convert it to a fraction.
$= \frac{32}{1\,000}$	Express the decimal as a fraction. Multiply both the numerator and the denominator by 10 for each digit after the decimal.
$= \frac{4}{125}$	Simplify the fraction.

(2)

SOLUTION 1.2.2

Steps	Explanation
$32.\dot{4}3\dot{5}$	Identify the decimal as a recurring decimal and you need to convert it to a fraction.
$x = 32.\dot{4}3\dot{5}$ (A)	Let x be equal to the decimal.
$1\,000x = 32435.\dot{4}3\dot{5}$ (B)	Multiply the decimal by a 1 000 to form another decimal.
$999x = 32\,403$ (B) – (A)	Subtract the two equations.
$x = \frac{32\,403}{999}$	Solve for x.
$x = \frac{10\,801}{333}$	Simplify the fraction.

(3)

SOLUTION 1.3 1.3.1

Steps	Explanation
0,58	Identify the decimal as a terminating decimal and you need to convert it to a fraction.
$= \frac{58}{100}$	Express the decimal as a fraction and multiply the numerator and denominator by 100.
$= \frac{29}{50}$	Simplify the fraction.

(1)

SOLUTION 1.3.2

Steps		Explanation
$0,\dot{4}8\dot{6}$		Identify the decimal as a recurring decimal and you need to convert it to a fraction.
$x = 0,\dot{4}8\dot{6}$	(A)	Let x be equal to the decimal.
$1\,000x = 486,486$	(B)	Multiply the equation by a 1 000 to form another decimal.
$999x = 486$	(B) – (A)	Subtract the two equations.
$\therefore x = \frac{486}{999}$		Solve for x.
$\therefore x = \frac{163}{333}$		Simplify the fraction.

(2)

SOLUTION 1.4 1.4.1

Steps	Explanation
0,14	Identify the decimal as a terminating decimal and you need to convert it to a fraction.
$= \frac{14}{100}$	Multiply the numerator and denominator by a 100.
$= \frac{7}{50}$	Simplify the fraction.

(1)

SOLUTION 1.4.2

Steps		Explanation
$4,2\dot{3}$		Identify the decimal as a recurring decimal and you need to convert it to a fraction.
$x = 4,2333$		Let x be equal to the decimal.
$10x = 42,333$	(A)	Create an equation by multiplying the decimal by a 10 to form an equation.
$100x = 423,333$	(B)	Create another equation by multiplying the decimal by a 100 to form an equation.
$90x = 381$	(B) – (A)	Subtract the two equations.
$x = \frac{381}{90}$		Solve for x.
$x = \frac{127}{30}$		Simplify the fraction.

(3)

SOLUTION 1.5

Steps	Explanation
C	Irrational numbers are real numbers that cannot be expressed as the ratio of two integers.

(1)

SOLUTION 1.6

Steps		Explanation
$0,\dot{4}5\dot{3}$		Identify the decimal as a recurring decimal and you need to convert it to a fraction.
Let $x = 0,\dot{4}5\dot{3}$	(A)	Let x be equal to the decimal.
$1\,000x = 453,\dot{4}5\dot{3}$	(B)	Multiply the decimal by a 1 000 to form another decimal.
$1\,000x - x = 453$	(B) – (A)	Subtract the two equations.
$999x = 453$		Simplify.
$x = \frac{453}{999}$		Solve for x.
$x = \frac{151}{333}$		Simplify the fraction.

(5)

SOLUTION 1.7

Steps	Explanation
D	Irrational numbers are real numbers that cannot be expressed as the ratio of two integers.

(1)

SOLUTION 1.8

Steps	Explanation
$4,\dot{4}1\dot{3}$	Identify the decimal as a recurring decimal and you need to convert it to a fraction.
Let $x = 4,\dot{4}1\dot{3}$	Let x be equal to the decimal.
$1\,000x = 4\,413,\dot{4}1\dot{3}$	Multiply the decimal by a 1 000 to form another decimal.
$999x = 4\,409$	Subtract the two equations.
$x = \frac{4\,409}{999}$	Solve for x.
$x = 4\frac{413}{333}$	Simplify.

(3)

QUESTION 2: Laws of exponents

SOLUTION 2.1 2.1.1

Steps	Explanation
$\dfrac{(-8x^2y)^2 \times (4xy^3)^2 \times (xy)}{(2xy^2)^2 \times (2xy)^3}$	Identify it as an expression with exponents.
$= \dfrac{64x^4y^2 \times 16x^2y^6 \times xy}{4x^2y^4 \times 8x^3y^3}$	Simplify the expression by applying the exponential law: $(a^m)^n = a^{m \times n}$
$= \dfrac{1024x^7y^9}{32x^2y^2}$	Apply the exponential law: $a^m \times a^n = a^{m+n}$
$= 32x^2y^2$	Simplify by applying the exponential law: $a^m \div a^n = a^{m-n}$

(4)

SOLUTION 2.1.2

Steps	Explanation
$\left(\dfrac{6a^5b^4}{12a^3b^{-2}}\right)^{-\frac{1}{3}}$	Identify it as an expression with exponents.
$= \left(\dfrac{a^2b^6}{2}\right)^{-\frac{1}{3}}$	First simplify inside the brackets.
$= \left(\dfrac{2}{a^2b^6}\right)^{\frac{1}{3}}$	Invert the fraction to get rid of the negative exponent.
$= \sqrt[3]{\dfrac{2}{a^2b^6}}$	Rewrite the fraction power as a cube root.
$= \dfrac{1}{b^2} \times \sqrt[3]{\dfrac{2}{a^2}}$	Simplify.

(3)

SOLUTION 2.2 2.2.1

Steps	Explanation
$\dfrac{\sqrt{16p^4} \times (p^4q^4)^0}{(2p)^2}$	Identify it as an expression with exponents.
$= \dfrac{4p^2 \times 1}{4p^2}$	Apply the exponential rules.
$= 1$	Simplify.

(3)

SOLUTION 2.2.2

Steps	Explanation
$\dfrac{(p^2q^2)^{2r} \times (pq^3)^{3r}}{(p^3q^3)^{2r}}$	This is an expression with exponents.
$= \dfrac{p^{4r}q^{4r} \times p^{3r}q^{9r}}{p^{6r}q^{6r}}$	Apply the exponential law: $(a^m)^n = a^{m \times n}$
$= \dfrac{p^{7r}q^{13r}}{p^{6r}q^{6r}}$	Apply the exponential law: $a^m \times a^n = a^{m+n}$
$= p^rq^{7r}$	Apply the exponential law: $a^m \div a^n = a^{m-n}$

(3)

SOLUTION 2.3 2.3.1

Steps	Explanation
$\sqrt{\dfrac{8^{10} + 4}{8^4 + 4^{11}}}$	Identify it as an expression with exponents. You need to simplify it without using a calculator.
$= \sqrt{\dfrac{(2^3)^{10} + (2^2)^{10}}{(2^3)^4 + (2^2)^{11}}}$	Write the bases as prime bases. Note you may not drop the bases as it is an expression and not an equation.
$= \sqrt{\dfrac{2^{30} + 2^{20}}{2^{12} + 2^{22}}}$	Simplify the expression by applying the exponential law: $(a^m)^n = a^{m \times n}$
$= \sqrt{\dfrac{2^{20}(2^{10} + 1)}{2^{12}(1 + 2^{10}}}$	Take out the HCF.
$= \sqrt{2^8}$	Cancel out.
$= 2^4$	Simplify the expression.
$= 16$	Simplify.

(3)

SOLUTION 2.3.2

Steps	Explanation
$\left(\dfrac{-x^2 - 2x^3 - 6x^3}{\sqrt{81x^6}}\right)^{13}$	Identify it as an expression with exponents.
$= \left(\dfrac{-9x^3}{9x^3}\right)^{13}$	Simplify the numerator and the denominator.
$= (-1)^3$	Simplify inside the brackets.
$= -1$	Simplify.

(4)

SOLUTION 2.4 2.4.1

Steps	Explanation
$2^{1-n}.2^{n+2}.2^0$	Identify it as an expression with exponents.
$= 2^{1-n+n+2+0}$	Apply the exponential law: $a^m \times a^n = a^{m+n}$
$= 2^{-1}$	Simplify.
$= \dfrac{1}{2}$	Apply exponential laws to get rid of the negative exponents.

(2)

SOLUTION 2.4.2

Steps	Explanation
$(4.\sqrt[3]{x^{15}y^{30}})^2 \times \frac{x^5y^3}{2x^2y^6}$	Identify it as an expression with exponents.
$= 4x^5y^{10} \times \frac{x^3}{2y^3}$	Simplify by applying the exponential law: $a^m \div a^n = a^{m-n}$
$= 2x^8y^7$	Simplify.

(3)

SOLUTION 2.5

Steps	Explanation
2.5.1 B	Factorise using difference between two squares.
2.5.2 D	Surd form
2.5.3 D	Apply exponential laws.

(6)

SOLUTION 2.6 2.6.1

Steps	Explanation
$2x^2y^3 \times 3x^5y^{-4}$	Identify it as an exponential expression.
$= 6x^7y^{-1}$	Multiply the coefficients. Apply the exponential law: $a^m \times a^n = a^{m+n}$
$= \frac{6x}{y}$	Simplify.

(2)

SOLUTION 2.6.2

Steps	Explanation
$\frac{(-2x^{-2}y^0z^{-1})^2 \times (x^0y)^3}{(xy^{-4}z^3)^{-1}}$	Identify it as an exponential expression.
$= \frac{(-2x^{-2}z^{-1})^2 \times (y)^3}{(xy^{-4}z^3)^{-1}}$	Apply the exponential law: $(am)^n = a^{m \times n}$
$= \frac{4x^{-4}z^{-2} \times y^3}{x^{-1}y^4z^{-3}}$	Simplify.
$= 4x^{-4-(-1)}.z^{-2-(-3)}.y^{3-4}$	Simplify by applying the exponential law: $a^m \div a^n = a^{m-n}$
$= 4x^{-3}zy^{-1}$	Apply the exponential law: $a^m \times a^n = a^{m+n}$
$= \frac{4z}{x^3y}$	Simplify.

(3)

SOLUTION 2.6.3

Steps	Explanation
$\frac{18^x \times 8^{x-2}}{9^{x+1} \times 4^{2x-3}}$	Identify it as an exponential expression. You may not use a calculator.
$= \frac{(2 \times 3^2)^x \times (2^3)^{x-2}}{(3^2)^{x+1} \times (2^2)^{2x-3}}$	Rewrite the number as prime bases.
$= \frac{2 \times 3^{2x}.2^{3x-6}}{3^{2x+2}.2^{4x-6}}$	Apply exponential laws and simplify.
$= \frac{2^x.3^{2x}.2^{3x-6}}{3^{2x+2}.2^{4x-6}}$	Rearrange so that same bases are together.
$= 2^{4x-6-4x+6}.3^{2x-2x-2}$	Apply exponential laws.
$= 2^0.3^{-2}$	
$= \frac{1}{9}$	Simplify without a calculator.

(3)

SOLUTION 2.7

Steps	Explanation
2.7.1 B	Use exponential laws.
2.7.2 B	Use exponential laws.

(4)

SOLUTION 2.8 2.8.1

Steps	Explanation
$\frac{3xy^{-2} \times x^0}{x^{-4}}$	Identify it as an expression with exponents.
$= \frac{3x \times 1 \times x^4}{y^2}$	Apply the exponential laws.
$= \frac{3x^5}{y^2}$	Simplify.

(2)

SOLUTION 2.8.2

Steps	Explanation
$\frac{x^2y^3 \times x^3y^4}{(2x^{-3}y)^2} \times \frac{x^5y^7}{\sqrt{4x^2y^3}}$	Identify the expression with exponents and a divide.
$= \frac{x^2y^3 \times x^3y^4}{2^2x^{-6}y^2} \times \frac{\sqrt{4x^2y^3}}{x^5y^7}$	Change the ÷ to a × and flip the fraction after the ÷.
$= \frac{2x^7y^{10}}{4x^{-1}y^9}$	Apply the exponential law: $a^m \times a^n = a^{m+n}$ Apply the exponential law: $(a^m)^n = a^{m \times n}$
$= \frac{x^8y}{2}$	Simplify.

(3)

SOLUTION 2.8.3

Steps	Explanation
$\left(\dfrac{6^x + x^6 + x^6}{-x^4 \times x^2}\right)^3$	Identify the expression with exponents. You need to simplify it without using a calculator.
$= \left(\dfrac{3x^6}{-x^5}\right)^3$	Add the like terms in the numerator. Apply the exponential law in the denominator.
$= (-3)^3$	Simplify inside the brackets.
$= -27$	Simplify.

(3)

SOLUTION 2.9 2.9.1

Steps	Explanation
$2x^2y^3 \times 3x^5y^{-4}$	Identify the algebraic expression containing exponents.
$= 6x^7y^{-1}$	Multiply the coefficients and apply the exponential laws: $a^m \times a^n = a^{m+n}$
$= \dfrac{6x}{y}$	Simplify by applying the exponential law: $y^{-1} = \dfrac{1}{y}$

(2)

SOLUTION 2.9.2

Steps	Explanation
$\dfrac{(-2x^{-2}y^0z^{-1})^2 \times (x^0y)^3}{(xy^{-4}z^3)^{-1}}$	Identify the algebraic expression containing exponents.
$\dfrac{(-2x^{-2}.1.z^{-1})^2\ (1.y)^3}{(xy^{-4}z^3)^{-1}}$	Simplify inside the bracket. Multiply the coefficients and apply the exponential law: $a^m \times a^n = a^{m+n}$
$= \dfrac{(-2x^{-2}z^{-1})^2 \times y^3}{(xy^{-4}z^3)^{-1}}$	Simplify by applying the exponential law: $a^0 = 1$
$= \dfrac{4x^{-4}z^{-2} \times y^3}{(x^{-1}y^4z^{-3})}$	Apply the exponential law: $(a^m)^n = a^{m \times n}$
$= 4x^{-4+1}z^{-2+3}y^{3-4}$	Apply the exponential law: $a^m \div a^n = a^{m-n}$
$= 4x^{-3}z^1y^{-1}$	Simplify.
$= \dfrac{4z}{x^3y}$	Write the variables with positive powers.

(3)

SOLUTION 2.9.3

Steps	Explanation
$\sqrt{\frac{2^x + 2^{x+2}}{2^x.5^{-1}}}$	Identify it as an exponential expression. Do not drop the base as it is not an equation.
$= \sqrt{\frac{2^x + 2^x 2^2}{2^x.5^{-1}}}$	Split the terms using the exponential law: $a^{x+y} = a^x \times a^y$
$= \sqrt{\frac{2^x(1 + 2^2)^2}{2^x.5^{-1}}}$	Factorise by taking out 2^x as a common factor.
$= \sqrt{\frac{(1 + 2^2)}{5^{-1}}}$	Cancel out.
$= \sqrt{5 \div \frac{1}{5}}$	Simplify.
$= \sqrt{25}$	Simplify.

(3)

QUESTION 3: Surds

SOLUTION 3.1 3.1.1

Steps	Explanation
$\frac{\sqrt{27} + \sqrt{48} + \sqrt{75}}{\sqrt{3} \times \sqrt{9}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{\sqrt{9 \times 3} + \sqrt{16 \times 3} + \sqrt{25 \times 3}}{\sqrt{3} \times \sqrt{9}}$	Rewrite the numbers into a square number and a factor.
$= \frac{\sqrt{9}\sqrt{3} + \sqrt{16}\sqrt{3} + \sqrt{25}\sqrt{3}}{\sqrt{3} \times \sqrt{9}}$	Split the number into a square number and a factor.
$= \frac{3\sqrt{3} + 4\sqrt{3} + 5\sqrt{3}}{\sqrt{3} \times 3}$	Simplify the square roots.
$= \frac{\sqrt{3}(3 + 4 + 5)}{\sqrt{3} \times 3}$	Factorise by taking out the HCF.
$= \frac{12}{3}$	Simplify.
$= 4$	Simplify.

(3)

SOLUTION 3.1.2

Steps	Explanation
$\frac{\sqrt{24} + 2\sqrt{6} + \sqrt{54} + \sqrt{150}}{\sqrt{96} - \sqrt{6}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{\sqrt{6 \times 4} + 2\sqrt{6} + \sqrt{6 \times 9} + \sqrt{25 \times 6}}{\sqrt{16 \times 6} - \sqrt{6}}$	Rewrite the numbers into a square number and a factor.
$= \frac{2\sqrt{6} + 2\sqrt{6} + 3\sqrt{6} + 5\sqrt{6}}{4\sqrt{6} - \sqrt{6}}$	Simplify the square roots.
$= \frac{4\sqrt{6} + 3\sqrt{6} + 5\sqrt{6}}{4\sqrt{6} - \sqrt{6}}$	Simplify.
$= \frac{\sqrt{6}(4 + 3 + 5)}{\sqrt{6}(4 - 1)}$	Factorise by taking out the HCF.
$= \frac{12}{3}$	Simplify.
$= 4$	Simplify.

(3)

SOLUTION 3.2

Steps	Explanation
$\frac{\sqrt{3}-1}{1+\sqrt{3}}$	Identify the expression as a surd expression with a surd in the denominator.
$=\frac{\sqrt{3}-1}{1+\sqrt{3}} \times \frac{1-\sqrt{3}}{1-\sqrt{3}}$	Multiply the expression with the conjugate of the denominator. Note the sign change in the conjugate.
$=\frac{(\sqrt{3}-1)(1-\sqrt{3})}{(1+\sqrt{3})(1-\sqrt{3})}$	Simplify the expression using your fraction skills.
$=\frac{\sqrt{3}-1-3+\sqrt{3}}{1+\sqrt{3}-3-\sqrt{3}}$	FOIL the numerator and the denominator.
$=\frac{2\sqrt{3}-4}{-2}$	Simplify the numerator and the denominator.
$=\frac{-2(-\sqrt{3}+2)}{-2}$	Factorise by taking out the HCF.
$= 2-\sqrt{3}$	Simplify.

(3)

SOLUTION 3.3

Steps	Explanation
$\frac{-\sqrt{125}+6\sqrt{80}+\sqrt{20}}{21\sqrt{5}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$=\frac{-\sqrt{5 \times 25}+6\sqrt{5 \times 16}+\sqrt{4 \times 5}}{21\sqrt{5}}$	Rewrite the numbers into a square number and a factor.
$=\frac{-5\sqrt{5}+24\sqrt{5}+2\sqrt{5}}{21\sqrt{5}}$	Simplify the square roots.
$=\frac{21\sqrt{5}}{21\sqrt{5}}$	Simplify by adding the like terms. You can also factorise by taking out the HCF.
$= 1$	Simplify.

(4)

SOLUTION 3.4

Steps	Explanation
$\frac{7}{1-\sqrt{8}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{7}{1-\sqrt{8}} \times \frac{1+\sqrt{8}}{1+\sqrt{8}}$	Multiply the expression with the conjugate of the denominator. Note the sign change in the conjugate.
$= \frac{7(1+\sqrt{8})}{1+\sqrt{8}-\sqrt{8}-8}$	Simplify the expression using your fraction skills.
$= \frac{7(1+\sqrt{8})}{-7}$	Factorise the numerator by taking out the HCF. Simplify the denominator.
$= -1-\sqrt{8}$	Simplify.

(4)

SOLUTION 3.5

Steps	Explanation
$\frac{\sqrt{125}+\sqrt{45}-\sqrt{20}}{2\sqrt{80}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{5\sqrt{5}+3\sqrt{5}-2\sqrt{5}}{8\sqrt{5}}$	Split the number into a square number and a factor. Simplify the square roots.
$= \frac{6\sqrt{5}}{8\sqrt{5}}$	Add the like terms.
$= \frac{3}{4}$	Simplify the fraction.

(3)

SOLUTION 3.6

Steps	Explanation
$\frac{\sqrt{36a^2}}{\sqrt{5}-\sqrt{6}}$	Identify the expression as a surd expression with a surd in the denominator.
$= \frac{\sqrt{36a^2}}{\sqrt{5}-\sqrt{6}} \times \frac{\sqrt{5}+\sqrt{6}}{\sqrt{5}+\sqrt{6}}$	Multiply the expression with the conjugate of the denominator. Note the sign change in the conjugate.
$= \frac{6a(\sqrt{5}+\sqrt{6})}{5+\sqrt{5}\sqrt{6}-\sqrt{5}\sqrt{6}-6}$	Simplify the expression using your fraction skills. Use FOIL to simplify the denominator,
$= \frac{6a\sqrt{5}+6a\sqrt{6}}{-1}$	Simplify.
$= -6a\sqrt{5}-6a\sqrt{6}$	Note the sign change when you divide by –1.

(4)

SOLUTION 3.7

Steps	Explanation
$\frac{2\sqrt{24} - 2\sqrt{6} + \sqrt{54}}{\sqrt{96} + \sqrt{6}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{2\sqrt{6} \times \sqrt{4} - 2\sqrt{6} + \sqrt{9} \times \sqrt{6}}{\sqrt{16} \times \sqrt{6} + \sqrt{6}}$	Split the number into a square number and a factor. Simplify the square roots.
$= \frac{4\sqrt{6} - 2\sqrt{6} + 3\sqrt{6}}{4\sqrt{6} + \sqrt{6}}$	Simplify.
$= \frac{5\sqrt{6}}{5\sqrt{6}}$	Simplify.

(3)

SOLUTION 3.8

Steps	Explanation
$\frac{6x^4\sqrt{2x^8} - 2\sqrt{8x^{16}}}{\sqrt{10x^{16}}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{6x^4.x^4\sqrt{2} - 2.2x^8\sqrt{2}}{\sqrt{2}.\sqrt{5}.x^8}$	Simplify the square roots.
$= \frac{6x^8\sqrt{2} - 4x^8\sqrt{2}}{\sqrt{2}.\sqrt{5}.x^8}$	Simplify.
$= \frac{2x^8\sqrt{2}}{\sqrt{2}.\sqrt{5}.x^8}$	Subtract the like terms.
$= \frac{2}{\sqrt{5}}$	Simplify.
$= \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$	Rationalise by multiplying with $\frac{\sqrt{5}}{\sqrt{5}}$.
$= \frac{2\sqrt{5}}{5}$	Simplify.

(5)

SOLUTION 3.9

Steps	Explanation
$\frac{\sqrt{6}}{\sqrt{6} - \sqrt{5}}$	Identify the expression as a surd expression with a surd in the denominator.
$= \frac{\sqrt{6}}{\sqrt{6} - \sqrt{5}} \times \frac{(\sqrt{6} + \sqrt{5})}{(\sqrt{6} + \sqrt{5})}$	Multiply the expression with the conjugate of the denominator. Note the sign change in the conjugate.
$= \frac{6 + \sqrt{30}}{6 + \sqrt{30} - \sqrt{30} - 5}$	Simplify the numerator. FOIL the denominator.
$= 6 + \sqrt{30}$	Simplify.

(3)

SOLUTION 3.10 3.10.1

Steps	Explanation
$\frac{\sqrt{10} - \sqrt{5}}{\sqrt{10}}$	Identify the expression as a surd expression. You simplify surds without using a calculator.
$= \frac{\sqrt{2}.\sqrt{5} - \sqrt{5}}{\sqrt{2}\sqrt{5}}$	Rewrite $\sqrt{10} = \sqrt{2}\sqrt{5}$
$= \frac{\sqrt{5}(\sqrt{2} - 1)}{\sqrt{2}.\sqrt{5}}$	Factorise by taking out the HCF.
$= \frac{(\sqrt{2} - 1)}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$	Simplify by multiplying with the conjugate.
$= \frac{\sqrt{2} - 1}{\sqrt{2}}$	Simplify.

(2)

SOLUTION 3.10.2

Steps	Explanation
$\frac{\sqrt{48x} + \sqrt{27x}}{\sqrt{48x}}$	The algebraic expression containing surds.
$= \frac{\sqrt{16.3x} + \sqrt{9.3x}}{\sqrt{16.3x}}$	Split the surd into the product of a square number and a number.
$= \frac{4\sqrt{3x} - 3\sqrt{3x}}{4\sqrt{3x}}$	Simplify by taking the square root of the square number.
$= \frac{1\sqrt{3x}}{4\sqrt{3x}}$	Add the similar terms.
$= \frac{1}{4}$	Simplify.

(3)

QUESTION 4: Manipulation and substitution

SOLUTION 4.1 4.1.1

Steps	Explanation
$T = 2\pi\left(\frac{l}{g}\right)^{\frac{1}{2}}$	Write down the formula.
$\left(\frac{T}{2\pi}\right) = \left(\frac{l}{g}\right)^{\frac{1}{2}}$	Get rid of 2π by dividing it.
$\left(\frac{T}{2\pi}\right)^2 = \left(\frac{l}{g}\right)$	Square the other side to get rid of the power $\frac{1}{2}$.
$\left(\frac{l}{g}\right) = \frac{T^2}{4\pi^2}$	Square it.
$l = \frac{gT^2}{4\pi^2}$	Get *l* alone by multiplying with *g*.

(3)

SOLUTION 4.1.2

Steps	Explanation
$l = \frac{gT^2}{4\pi^2}$	Write down the formula.
$l = \frac{9{,}8(4)^2}{4\pi^2}$	Substitute the values into the formula.
$l = 3{,}972$ m	Use your calculator to determine the value of *l*.

(2)

SOLUTION 4.2 4.2.1

Steps	Explanation
$s = \frac{r}{2}(a + b)$	Write down the formula.
$2S = r(a + b)$	Kick over the 2.
$\frac{2S}{r} = (a + b)$	Divide by *r*.
$\frac{2S}{r} - a = b$	Kick over *a* to get *b* alone.
$b = \frac{2S - ar}{r}$	Write in fraction form.

(3)

SOLUTION 4.2.2

Steps	Explanation
$b = \frac{2S - ar}{r}$	Write down the formula.
$b = \frac{2(10) - 2(12)}{12}$	Substitute the values into the formula.
$b = \frac{20 - 24}{12}$	Simplify.
$b = \frac{-4}{12}$	Simplify.
$b = -\frac{1}{3}$	Write in fraction form.

(2)

SOLUTION 4.3 4.3.1

Steps	Explanation
$Z = \frac{2pq}{r + 2}$	Write down the formula.
$Z(r + 2) = 2pq$	Multiply by $(r + 2)$ to isolate the $2pq$ term.
$\frac{Z(r + 2)}{2p} = q$	Divide by $2p$ to isolate q.
$q = \frac{Zr + 2Z}{2p}$	Write the subject on the left-hand side of the equation.
$q = \frac{Z}{2p} + \frac{2Z}{2p}$	Simplify.

(2)

SOLUTION 4.3.2

Steps	Explanation
$q = \frac{Z(r + 2)}{2p}$	Write down the formula.
$q = \frac{20(4 + 2)}{2(10)}$	Substitute the values into the formula.
$q = \frac{20(6)}{20}$	Simplify inside the brackets.
$q = 6$	Simplify.

(2)

SOLUTION 4.4 4.4.1

Steps	Explanation
$T = \frac{pr^2}{q}$	Write down the formula.
$Tq = pr^2$	Multiply the left-hand side by q to get rid of the fraction.
$\frac{Tq}{p} = r^2$	Divide by p to isolate r^2.
$r = \sqrt{\frac{Tq}{p}}$	Take the square root to isolate r.

(3)

SOLUTION 4.4.2

Steps	Explanation
$r = \sqrt{\frac{Tq}{p}}$	Write down the formula.
$r = \sqrt{\frac{20(14)}{12}}$	Substitute the values into the formula.
$r = \sqrt{\frac{280}{12}}$	Simplify under the root sign.
$r = 4{,}83$	Take the square root to isolate r.

(2)

SOLUTION 4.5 4.5.1

Steps	Explanation
$A_T = A_o + A_o \times \frac{r \times t}{100}$	Write down the formula.
$A_T = A_o\ (1 + \frac{r \times t}{100}$	Factorise the right-hand side by taking A_o out as a common factor.
$A_o = \frac{A_T}{\left(1 + \frac{r \times t}{100}\right)}$	Divide by p to isolate r^2.

(2)

SOLUTION 4.5.2

Steps	Explanation
$A_o = \frac{A_T}{\left(1 + \frac{r \times t}{100}\right)}$	Write down the formula.
$A_o = \frac{3\ 000}{\left(1 + \frac{5 \times 4}{100}\right)}$	Substitute the values into the formula.
$A_o = \frac{3\ 000}{\left(1 + \frac{20}{100}\right)}$	Simplify .
$A_o = 2\ 000$	Use a calculator and simplify.

(2)

QUESTION 5: Arithmetic sequences and series

SOLUTION 5.1

Steps	Explanation
$a = 3$ $d = T_2 - T_1$ $= 7 - 3$ $= 4$	Find the difference *d* and identify the first term *a*. Use the correct symbols.
$S_n = \frac{n}{2}[2a + (n - 1)d]$	Write the formula for the sum of an arithmetic sequence.
$S_n = \frac{14}{2}[2(3) + (14 - 1)(4)]$	Substitute the values into the formula.
$S_n = 7[(58)]$	Simplify inside the brackets from the inside.
$S_n = 406$	Simplify.

(3)

SOLUTION 5.2

Steps	Explanation
$a = 5$, $d = 3$ and $n = 13$	Find the difference *d* and identify the first term *a*. Use the correct symbols.
$T_n = a + (n - 1)d$	Write the formula for an arithmetic sequence.
$T_{13} = 5 + (13 - 1)3$	Substitute the values into the formula.
$T_{13} = 5 + (12)3$	Simplify inside the brackets from the inside.
$T_{13} = 5 + 36$	Simplify the brackets.
$T_{13} = 41$	Simplify.

(4)

SOLUTION 5.3

Steps	Explanation
Given: $T_6 = 38$ and $d = 3$	Find the difference d and identify the first term a. Use the correct notation to indicate T_6
$T_n = a + (n - 1)d$	Write the formula for the sum of an arithmetic sequence.
$T_6 = a + (6 - 1)d$	Substitute the values into the formula.
$38 = a + (5)(3)$	Simplify inside the brackets.
$38 = a + 15$	Simplify.
$a = 38 - 15$	Get a alone. a is the first term.
$a = 23$	Simplify.
$T_{12} = 23 + (12 - 1)3$	Substitute the values into the arithmetic formula.
$T_{12} = 23 + (11)(3)$	Simplify inside the brackets.
$T_{12} = 56$	Simplify and check if the answer is meaningful.
The first term is 23 and 12th term is 56.	

(6)

SOLUTION 5.4

Steps	Explanation
$S_{16} = 166$ $n = 16$ $d = 3$ $a = ?$	Find the difference d and identify the first term a. Use the correct symbols.
$S_n = \frac{n}{2}[2a + (n - 1)d]$	Write the formula for the sum of an arithmetic sequence.
$166 = \frac{16}{2}[2a + (16 - 1)(3)]$	Substitute the values into the formula.
$166 = 8(2a + 45)$	Simplify inside the brackets.
$166 = 16a + 360$	Simplify by removing the brackets.
$-194 = 16a$	Simplify.
$a = -12{,}125$	Simplify.

(4)

SOLUTION 5.5 5.5.1

Steps	Explanation
-2	

(1)

SOLUTION 5.5.2

Steps	Explanation
$a = 7$ $d = -3$ $T_n = -26$ $n = ?$	Find the difference d and identify the first term a. Use the correct notation to indicate T_n
$T_n = a + (n - 1)d$	Write the formula for the sum of an arithmetic sequence.
$-26 = 7 + (n - 1)(-3)]$	Substitute the values into the formula.
$-26 = 7 - 3n + 3$	Simplify inside the brackets.
$3n = 36$	Get the n term on one side.
$n = \frac{-36}{-3}$	Simplify.
$n = 12$	Get n alone.

(4)

SOLUTION 5.6

Steps	Explanation
$a = 16$ $S_{52} = 8\,788$	Find the values of arithmetic series and list them. Use the correct notation.
$S_n = \frac{n}{2}[2a + (n - 1)d]$	Write down the formula of S_n for an arithmetic sequence. You need to determine the difference d.
$8\,788 = \frac{52}{2}[2(16) + (52 - 1)d]$	Substitute the values into the equation.
$8\,788 = 26(32 + 51d)$	Simplify the equation.
$8\,788 = 832 + 1\,326d$	Remove the brackets.
$7\,956 = 1\,326d$	Formula manipulation.
$\therefore d = 6$	Isolate d.

(4)

SOLUTION 5.7 5.7.1

Steps	Explanation
$n = 10$, $a = 2$ and $d = 3$	Find the difference d and identify the first term a. Use the correct notation to indicate T_6
$T_n = a + (n - 1)d$	Write the formula for the arithmetic sequence.
$T_{10} = 2 + (10 - 1)3$	Substitute the values into the formula.
$T_{10} = 29$	Simplify.

(3)

SOLUTION 5.7.2

Steps	Explanation
$n = 25$, $a = 2$ and $d = 3$	Find the values and list them. Use the correct notation.
$S_n = \frac{n}{2}[2a + (n - 1)d]$	Write the formula for the sum of an arithmetic sequence.
$S_{25} = \frac{25}{2}[2(2) + (25 - 1)(3)]$	Substitute the values into the S_n formula.
$S_{25} = 950$	Use your calculator to determine S_{25}

(3)

SOLUTION 5.8 5.8.1

Steps	Explanation
$T_n = 17$	Identify the term.

(1)

SOLUTION 5.8.2

Steps	Explanation
$T_n = a + (n - 1)d$	Write the formula for the arithmetic sequence.
$161 = 5 + (n - 1)4$	Substitute the values into the formula.
$161 - 5 \pm 4n - 4$	Simplify by removing the brackets.
$160 = 4n$	Isolate $4n$.
$\therefore n = 40$	Simplify.

(3)

SOLUTION 5.8.3

Steps	Explanation
$S = \frac{n}{2}[2a + (n - 1)d]$	Write the formula for the sum of an arithmetic sequence.
S = 12[2(5) + (12 – 1)4]	Substitute the values into the formula.
$S_{12} = 6[2(5) + (11)4]$	Simplify the brackets from the inside.
$S_{12} = 324$	Simplify.

(2)

SOLUTION 5.9 5.9.1

Steps	Explanation
2; 6; 10; 14; 18; 22; 26 ...	Expand the arithmetic sequence by adding 4 every time.

(2)

SOLUTION 5.9.2

Steps	Explanation
$T_n = a + (n - 1)d$	Write the formula for the arithmetic sequence.
T = 2 + (49)4	Substitute the values into the formula.
$T_{50} = 2 + 196$	Simplify by removing the brackets.
$T_{50} = 198$	Simplify.

(2)

SOLUTION 5.9.3

Steps	Explanation
$T_n = a + (n - 1)d$	Write the formula for the arithmetic sequence.
$2\,862 = 2 + (n - 1)4$	Substitute the values into the formula.
$2\,860 = 4n - 4$	Simplify by removing the brackets
$2\,864 = 4n$	Simplify and isolate $4n$.
$\therefore n = 716$ years	Get n alone.

(3)

Question papers Maths L2

Introduction to Paper 1 and Paper 2

Proposed mark distribution between Paper 1 and Paper 2 for external examination papers

Paper 1	
Topics	**Marks**
1. Numbers	30
2. Functions and Algebra	
2.1 Functions	25
2.2 Algebra	25
5. Financial Mathematics	20
Total	**100**

Paper 2	
Topics	**Marks**
3. Space, Shape and Measurement	
3.1 Geometry	30
3.2 Trigonometry	30
4. Data Handling	40
Total	**100**

Chapter 2: **Functions and Algebra**
(Paper 1)

Part A: Functions

QUESTION 1: Straight lines

SOLUTION 1.1

Steps	Explanation
1.1.1 Straight line graph	Linear equation produces a straight line.
1.1.2 Positive gradient	Increasing graph
1.1.3 Continuous	No gaps in the graph

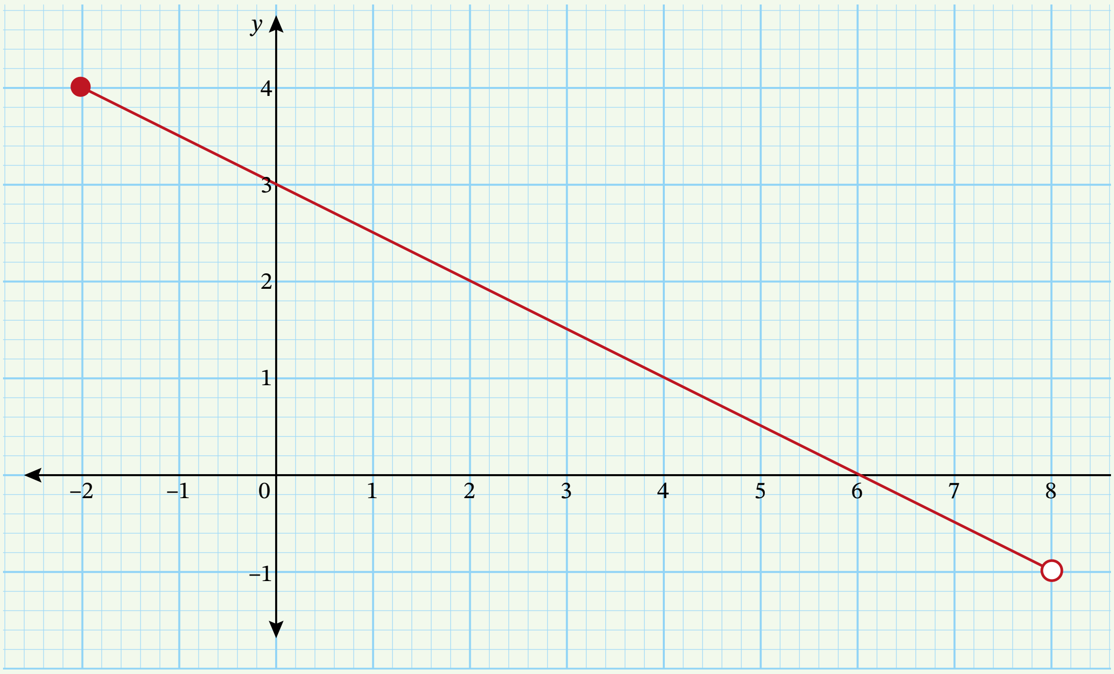
(3)

SOLUTION 1.2

Steps	Explanation
1.2.1 A	Horizontal asymptote for the graph g
1.2.2 D	Range of graph $g(x)$
1.2.3 A	Look at the y-values.
1.2.4 C	The graph is a function.
1.2.5 C	Note the restriction on the domain.
1.2.6 D	Look at the x-intercept.

(6)

SOLUTION 1.3 1.3.1

Steps	Explanation
	
(6; 0) and (0; 3)	*x*-intercept and *y*-intercept
(9; –1) and (–2; 4)	End points correctly placed
(9; –1) and (–2; 4)	Open dot and closed dot

(3)

SOLUTION 1.3.2

Steps	Explanation
Range $y \in (-1; 4]$ where $y \in R$	Round bracket for open dot and square bracket for a closed dot.

(2)

SOLUTION 1.4

Steps	Explanation
A	Restriction on domain

(1)

SOLUTION 1.5 1.5.1

Steps	Explanation
$m = \frac{y_2 - y_1}{x_2 - x_1}$	Use the gradient formula.
$m = \frac{1 + 2}{5 - 0}$	Substitute the values.
$m = \frac{3}{5}$	Simplify.
$y = \frac{3}{5}x - 2$	Equation of line with y-intercept = –2

(2)

SOLUTION 1.5.2

Steps	Explanation
Straight-line graph	It is in the $y = mx + c$ format.

(1)

SOLUTION 1.5.3

Steps	Explanation
$x \neq 2$ where $x \in$ R	The domain is all real numbers excluding $x = 2$.
OR	
$\{x \mid x < 2$ or $x > 2$ where $x \in$ R$\}$	This is in set builder's notation.
OR	
$x \in (-\infty; 2)$ and $(2; \infty)$ where $x \in$ R	Use interval notation but exclude $x = 2$.

(2)

SOLUTION 1.5.4

Steps	Explanation
Discontinuous	The graph has a hole at $x = 2$. Therefore the function is not defined at $x = 2$.

(2)

QUESTION 2: Parabola

SOLUTION 2.1

Steps	Explanation
2.1.1 (0; –4)	Let $x = 0$ and $y = (0)^2 - 4$
2.1.2 $x = -2$ **OR** $x = 2$	Let $y = 0$ and solve for x by factorising.
2.1.3 $x = 0$ **OR** y-axis	The axis of symmetry of a parabola is a vertical line that divides a parabola into two halves. This line passes through the vertex of the parabola.
2.1.4 Continuous	No gaps in the graph
2.1.5 Function	Do the vertical line test.
2.1.6 Parabola	Quadratic function

(8)

SOLUTION 2.2 2.2.1

Steps	Explanation
x–intercepts: Let $y = 0$	Substitute $y = 0$.
$0 = 12 - 3x^2$	Set the quadratic equation equal to 0.
$3x^2 - 12 = 0$	Write the equation in standard form.
$3(x^2 - 4) = 0$	Take out the HCF.
$(x - 2)(x + 2) = 0$	Factorise.
$x = 2$ or $x = -2$	Isolate x.

(3)

SOLUTION 2.2.2

Steps	Explanation
$y = 12 - 3x^2$	y-intercepts: Let $x = 0$
$y = 12$	The y-intercept coordinate (12; 0)

(2)

SOLUTION 2.2.3

Steps	Explanation
$x = \frac{-b}{2a}$	Formula for axis of symmetry
$x = \frac{-0}{2(-3)}$	Substitute values into the formula.
$x = 0$	The answer must be given as an equation.

(2)

SOLUTION 2.2.4

Steps	Explanation
$y = 12 - 3(0)^2$	Substitute value $x = 0$ into the formula.
$y = 12$	Simplify.
Turning point (0; 12)	Write as a coordinate.

(2)

SOLUTION 2.2.5

Steps	Explanation
$(-\infty; 12]$ **OR** $-\infty < y \leq 12$ **OR** $\{y: -\infty < y \leq 12: y \in R\}$	Range is from negative infinity to 12.

(1)

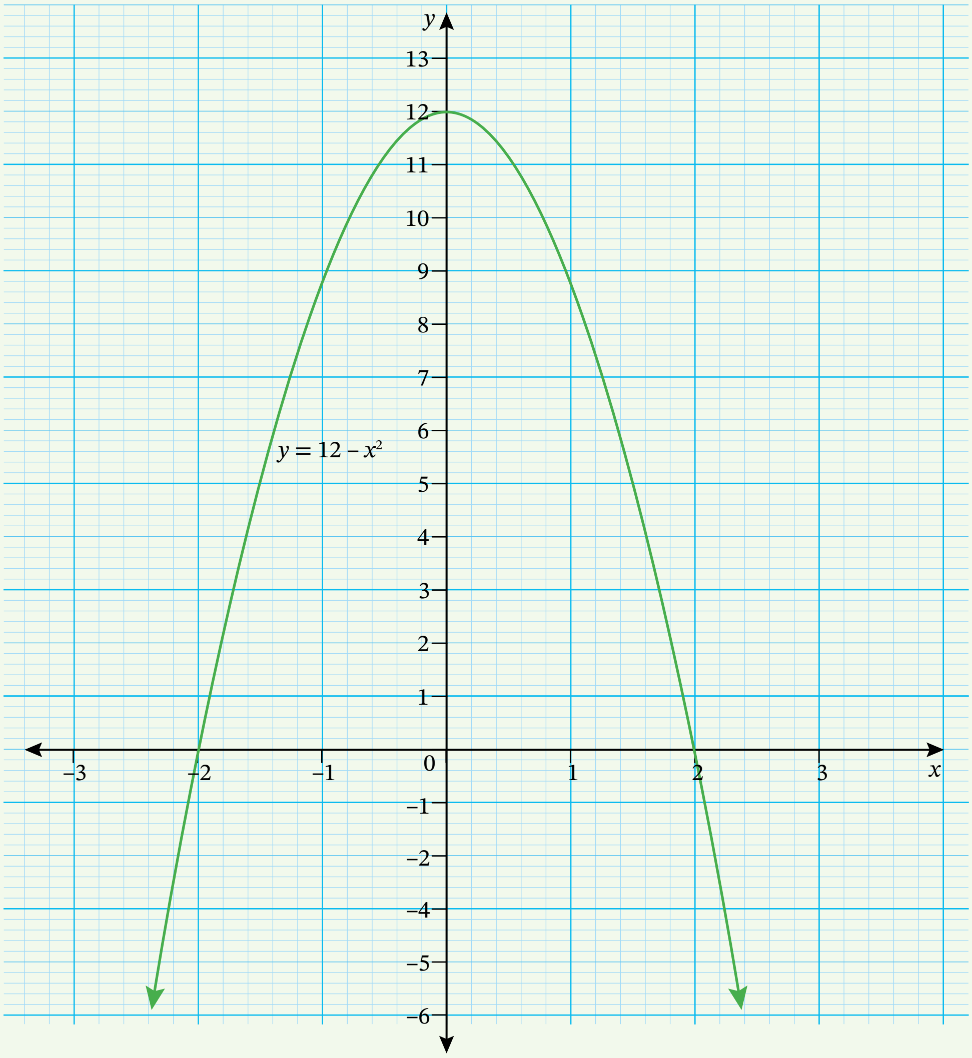
SOLUTION 2.2.6

Steps	Explanation
$(-\infty; \infty)$ **OR** $-\infty < x < \infty$ **OR** $\{x: -\infty < x < \infty: x \in R\}$	Domain is from negative infinity to positive infinity.

(1)

SOLUTION 2.2.7

Graph



(3)

SOLUTION 2.3

Steps	Explanation
2.3.1 Quadratic function	It is a parabola.
2.3.2 Continuous	No gaps in the graph.
2.3.3 $x = 0$ or y-axis	The y-intercept.
2.3.4 Function: It is a one-to-one function.	For every x-value there is one y-value. The vertical line test cuts the graph at one point only.
2.3.5 Domain: $(-\infty; \infty)$ Range: $(0; \infty)$	Domain is from negative infinity to positive infinity.
2.3.6 y-intercept = 0	Intercept at (0; 0) on the y-axis.
2.3.7 $g(x) = x^2 - 1$	Vertical shift down.

(10)

SOLUTION 2.4

Steps	Explanation
$y = ax^2 + q$	Write the standard quadratic equation form.
$1 = a(2)^2 + q$	Substitute point (2; 1) in the standard equation.
$\therefore 1 = 4a + q$ .... (A)	Simplify.
Substitute point (–1; 4) in the standard equation:	Create another equation.
$y = ax^2 + q$	Write the standard quadratic equation form.
$4 = a(-1)^2 + q$	Substitute point (2; 1) in the standard equation.
$\therefore 4 = a + q$ .... (B)	Simplify.
Equation (B) – (A):	
$4 - 1 = a + q - (4a + q)$	Subtract the two equations.
$3 = -3a$	Simplify.
$a = -1$	Isolate a.
$1 = 4(-1) + q$	Substitute $a = -1$ into equation (A).
$q = 4 + 1$	Simplify.
$q = 5$	Simplify.
$y = -x^2 + 5$	The equation of the parabola

(8)

SOLUTION 2.5

Steps	Explanation
2.5.1 Parabola	It is a quadratic function.
2.5.2 (0; 0)	The turning point is the origin.
2.5.3 $x = 0$ **OR** y-axis	The axis of symmetry is the centre line of the parabola.
2.5.4 It is a function as for every x-value there is only one y-value.	Parallel line will cut the x-axis only once.
2.5.5 $= x^2 - 2$	

(6)

SOLUTION 2.6 2.6.1

<table>
<tr><th>Steps</th><th>Explanation</th></tr>
<tr><td>

x	–2	–1	0	1	2
$g(x) = 2x^2 + 3$	11	5	3	5	11

</td><td>Substitute the x-values into $f(x)$ to get the y-values. Note it is a smiling face.</td></tr>
</table>

(2)

SOLUTION 2.6.2

Steps	Explanation
The graphs of $f(x) = 2x^2 + 3$ and $g(x) = -2x^2 + 3$	See the graph of the parabola at 2.6.4.

(3)

SOLUTION 2.6.3

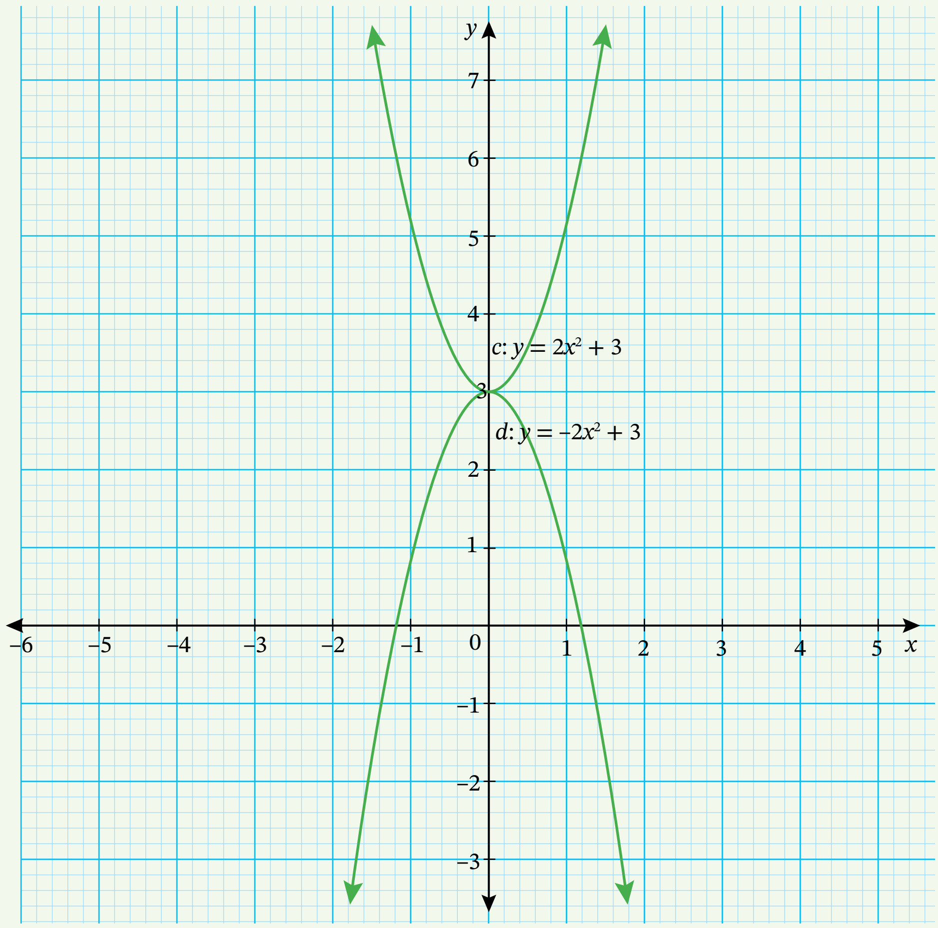
<table>
<tr><th>Steps</th><th>Explanation</th></tr>
<tr><td>

x	–2	–1	0	1	2
$g(x) = -2x^2 + 3$	–5	1	3	1	–5

</td><td>Substitute the x-values into $f(x)$ to get the y-values. Note it is a sad face.</td></tr>
</table>

(2)

SOLUTION 2.6.4

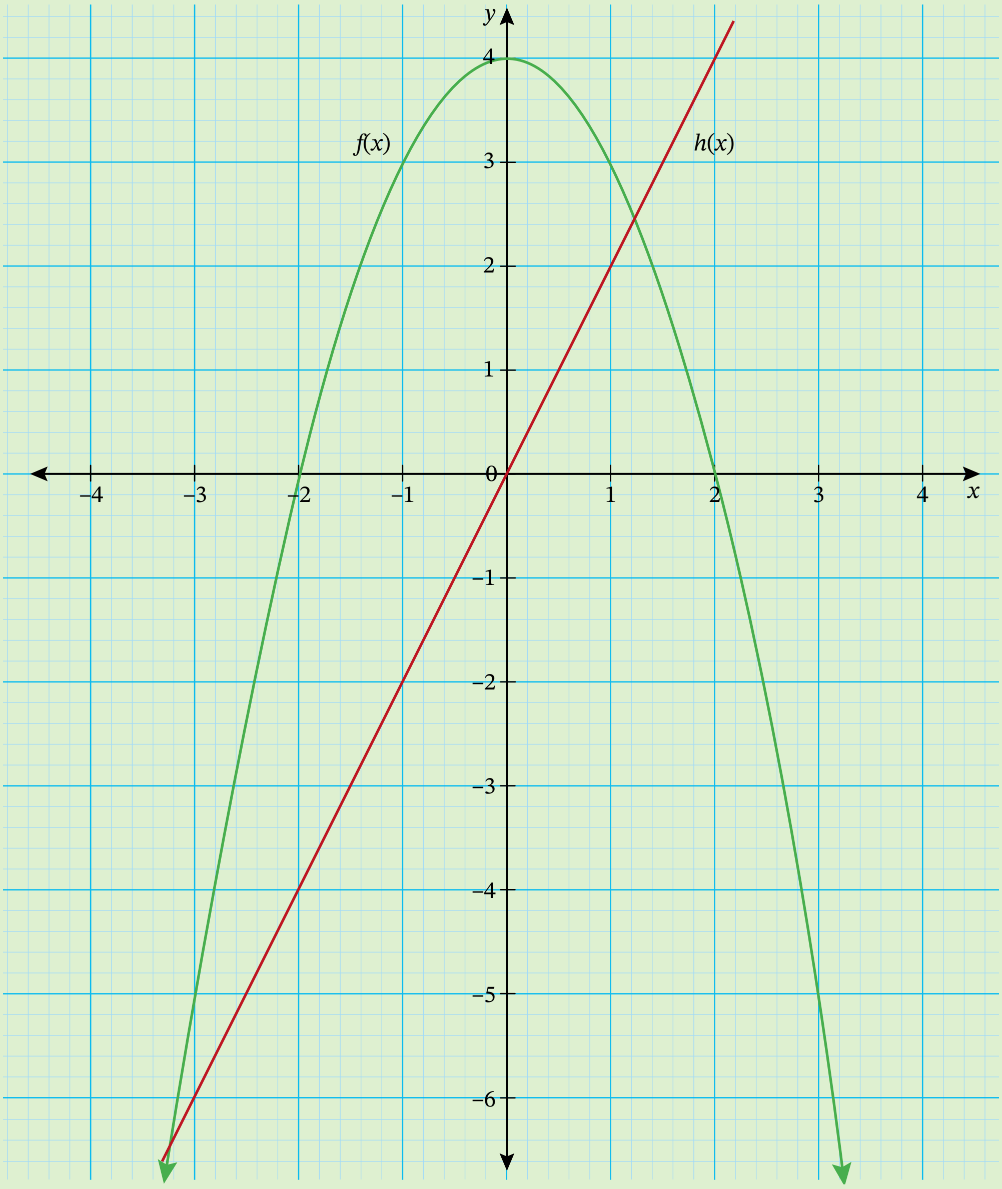


(3)

SOLUTION 2.7

x	−3	−2	−1	0	1	2	3
$f(x) = -x^2 + 4$	−5	0	3	4	3	0	−5

x	−2	−1	0	1	2
$h(x) = 2x$	−4	−2	0	2	4



Steps	Explanation
Turning point of parabola $f(x)$	Turning point is on the y-axis.
Shape of parabola $f(x)$	It is the maximum turning point.
Straight line $h(x)$ graph passing through origin	Straight line graph passing through (0; 0)
Straight line $h(x)$ has a positive gradient.	The straight line graph is increasing from left to right (as you read the graph is going up).

(5)

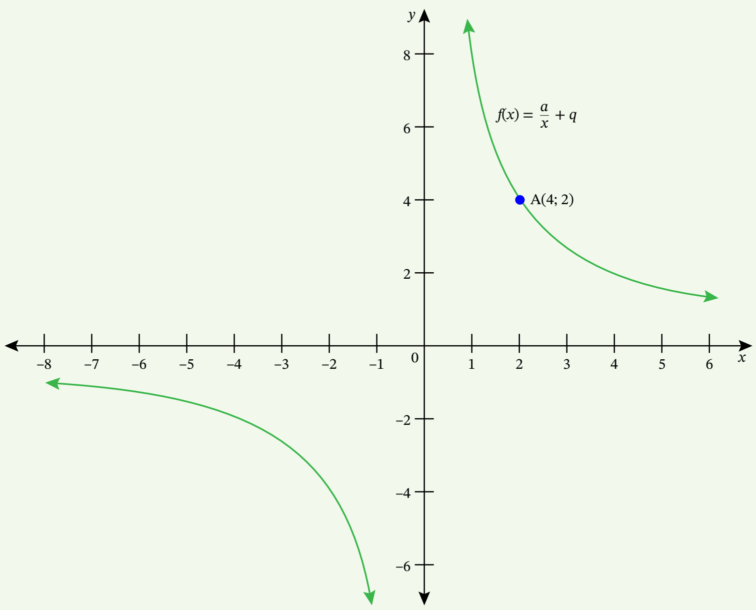
QUESTION 3: Hyperbolas

SOLUTION 3.1 3.1.1

Steps	Explanation
Rectangular hyperbola	Identify the function.

(1)

SOLUTION 3.1.2

Steps	Explanation
	
$f(x) = \frac{a}{x} + q$	Standard equation of the hyperbola.
$y = \frac{a}{x}$	The horizontal asymptote is $y = 0$, therefore $q = 0$.
$2 = \frac{a}{4}$	Substitute (4; 2) into the standard form.
$a = 2 \times 4 = 8$	Find the a value.

(3)

SOLUTION 3.2 3.2.1

Steps	Explanation
Hyperbola	Identify the function.

(1)

SOLUTION 3.2.2

Steps	Explanation
Domain: $x \in (-\infty; \infty)$ but $x \neq 0$	Domain is from negative infinity to positive infinity.
Range: $y \in (-\infty; \infty)$ but $y \neq 3$	Range is from negative infinity to positive infinity excluding $y = 3$.

(2)

SOLUTION 3.2.3

Steps	Explanation
Discontinuous graph	The pencil cannot run over the whole graph as it must be lifted to complete the graph.

(2)

SOLUTION 3.2.4

Steps	Explanation
Function	• It's a one-to-one function, for every *x*-value there is one *y*-value. • The vertical line cuts the graph at only one point.

(2)

SOLUTION 3.3 3.3.1

Steps	Explanation
Hyperbola	Identify the function.

(1)

SOLUTION 3.3.2

Steps	Explanation
Asymptote at $x = 0$	
Asymptote at $y = 2$	
In the first and third quadrant as $a > 0$	

(4)

SOLUTION 3.3.3

Steps	Explanation
$y \in (-\infty; \infty)$ but $y \neq 2$	Look at the asymptote $y = 2$ as that is excluded from the range.

(1)

SOLUTION 3.3.4

Steps	Explanation
The graph is discontinuous.	The pencil cannot run over the whole graph as it must be lifted to complete the graph.

(1)

SOLUTION 3.4 3.4.1

Steps	Explanation
Hyperbola	Standard equation of the hyperbola

(1)

SOLUTION 3.4.2

Steps	Explanation
$xy = k$	Standard equation of the hyperbola
$2 \times 4 = k$	Substitute (4; 2) into the standard form.
$k = 8$	Find the value of 8.
$y = \frac{8}{x}$	Write the equation of the hyperbola.

(3)

SOLUTION 3.4.3

Steps	Explanation
Exponential graph	Standard equation of the exponential graph

(1)

SOLUTION 3.4.4

Steps	Explanation
y-intercept coordinates: (0; 1)	If you substitute $x = 0$ into $y = 2^x$ then $y = 2^0 = 1$
Domain: $x \in (-\infty; \infty)$ **OR** $x \in R$	The domain of a function is the set of all possible input values (x).
Range: $y \in (0; \infty)$ **OR** $y > 0$	The range is the set of all possible output values (y) that the function can produce.

(3)

SOLUTION 3.5 3.5.1

Steps	Explanation
(a) F	This is a hyperbola and not an exponential graph.
(b) T	The graph is discontinuous.
(c) F	The domain for this graph is $x \in R$; $x \neq 0$.
(d) F	The q-value is the horizontal asymptote.
(e) F	The hyperbola is a function as for every x-value there is only one y-value.

(5)

SOLUTION 3.5.2

Steps	Explanation
$y = \frac{a}{x} + q$	Identify the function as a hyperbola.
$q = 1$	The horizontal asymptote is the q-value.
$0 = \frac{a}{-3} + 1$	Substitute the coordinate (–3; 0) into the formula.
$\frac{a}{3} = 1$	Simplify.
$a = 3$	Solve for a.

(2)

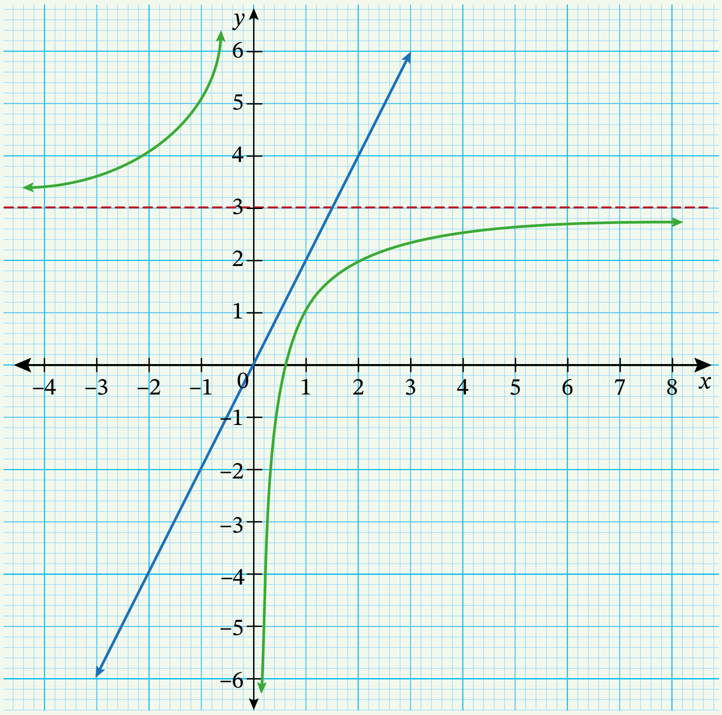
SOLUTION 3.5.3

Steps	Explanation
Horizontal asymptote: $y = 1$	Asymptotes of a hyperbola are straight lines that the hyperbola approaches but never intersects.
Vertical asymptote: $x = 0$	The vertical asymptote is the value where the function will be undefined.

(2)

SOLUTION 3.6 3.6.1

Steps	Explanation
Straight-line graph See graph below.	The straight line goes through the origin with an open point at (4; 8) and closed point (–2; –4).
Hyperbola: See graph below.	The hyperbola has asymptotes at $y = 3$ and $x = 0$.



(5)

SOLUTION 3.6.2

Steps	Explanation
$y \in R$	The range is all the real numbers excluding the asymptote $y = 3$.

(2)

SOLUTION 3.6.3

Steps	Explanation
$y = 3$	Asymptotes are lines that a curve gets closer to as it extends to infinity. The horizontal asymptotes are the horizontal lines the graph approaches as x goes to $+\infty$ or $-\infty$.
$x = 0$	Vertical asymptotes: Lines where the function heads toward infinity near certain x-values.

(2)

SOLUTION 3.6.4

Steps	Explanation
Hyperbola	The graph will lie in the first and third quadrant (a is positive).

(1)

QUESTION 4: Exponential curves

SOLUTION 4.1 4.1.1

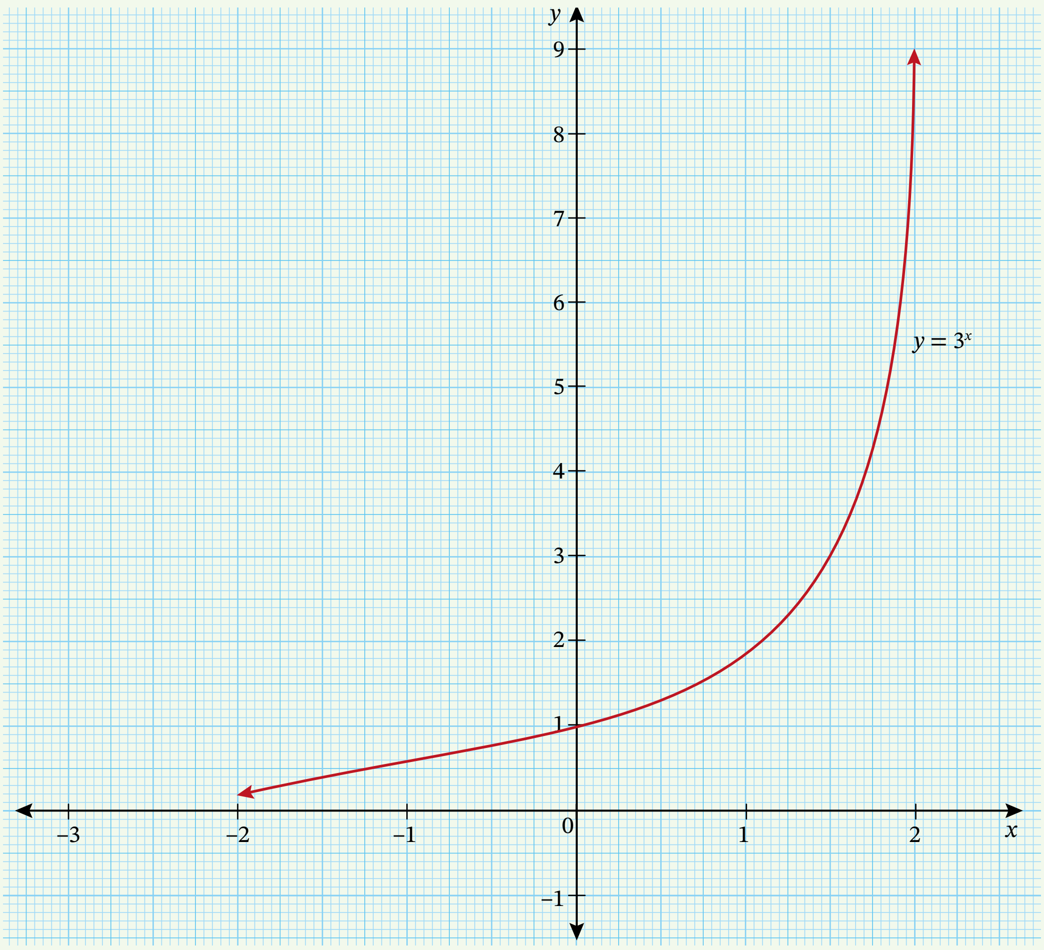
<table>
<tr><th>Steps</th><th>Explanation</th></tr>
<tr><td>

x	–2	–1	0	1	2
$y = 3^x$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9

</td><td>Substitute the x-values into $f(x)$ to get the y-values.</td></tr>
</table>

(5)

SOLUTION 4.1.2

<table>
<tr><th>Steps</th><th>Explanation</th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>The graph of $y = 3^x$</td><td>Exponential graph</td></tr>
</table>

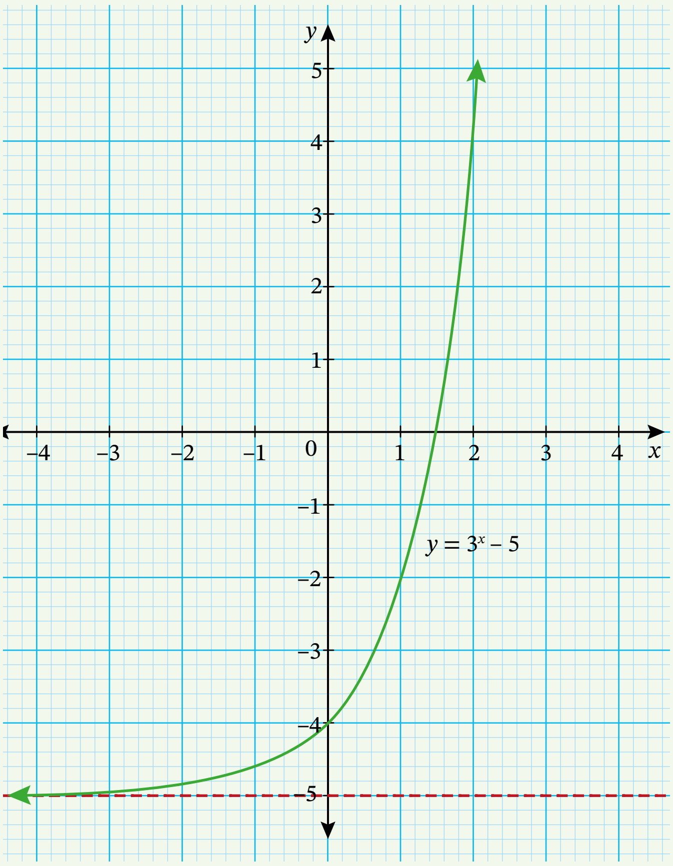
(3)

SOLUTION 4.1.3

Steps	Explanation
Continuous	A continuous function is one that can be drawn without lifting your pencil from the paper, while a discontinuous function has breaks, jumps, or holes in its graph.

(1)

SOLUTION 4.2

Steps	Explanation
	
Asymptote $y = -5$	Start by drawing the asymptote $y = -5$ as a dotted line on the cartesian plane. Use a ruler and label it.
Orientation of the exponential graph	The graph will look like a J as the base is a natural number.
Intercepts (0; –4) (1,5; 0)	To determine the y-intercept, substitute 0 for the x-value in the function and solve for y.

(4)

SOLUTION 4.3

Steps	Explanation
4.3.1 B	The horizontal asymptote
4.3.2 D	Look at the y-values to get the range.
4.3.3 D	Look at the graph.
4.3.4 A	The graph of $g(x) = ab^x + q$ is increasing.
4.3.5 C	The equation of the exponential graph
4.3.6 D	The asymptote of the exponential graph is at $y = 3$.
4.3.7 B	The a impacts the steepness and direction of the graph.

(7)

Part B: Algebra

QUESTION 1: Simplify algebraic expressions

SOLUTION 1.1 1.1.1

Steps	Explanation
$(x^2 - 1)^2 - 1$	Identify the algebraic expression as a difference between two squares.
$= (x^2 - 1)(x^2 - 1) - 1$	Write the square brackets out.
$= (x^4 - x^2 - x^2 + 1) - 1$	Use FOIL to simplify the first two brackets.
$= (x^4 - 2x^2 + 1) - 1$	Simplify inside the brackets.
$= x^4 - 2x^2 + 1 - 1$	Remove the brackets.
$= x^4 - 2x^2$	Simplify.
OR	
$(x^2 - 1)^2 - 1$	Identify the algebraic expression as a difference between two squares.
$= (x^2 - 1)^2 - 1^2$	Write 1 as a square number.
$= [(x^2 - 1) + 1][(x^2 - 1) - 1]$	Factorise.
$= [x^2 - 1 + 1][x^2 - 1 - 1]$	Remove brackets.
$= x^2(x^2 - 2)$	Simplify.
$= x^4 - 2x^2$	Simplify again by removing the brackets.

(3)

SOLUTION 1.1.2

Steps	Explanation
$(-x^2 - 2x)(-x + 3)$	Identify the algebraic expression as a two term multiply by a two term. You need to remove the brackets.
$= x^3 + 2x^2 - 3x^2 - 6x$	Carefully use FOIL to remove the brackets.
$= x^3 - x^2 - 6x$	Simplify.

(2)

SOLUTION 1.1.3

Steps	Explanation
$((2x + 1)(-x))^2$	Identify the algebraic expression as a binomial multiply by a monomial. You need to remove the brackets.
$= (-2x^2 - x)^2$	Use the distribution law and simplify inside the bracket.
$= (-2x^2 - x)(-2x^2 - x)$	Write the brackets twice to make it easier to FOIL.
$= 4x^4 + 2x^3 + 2x^3 + x^2$	FOIL the binomials.
$= 4x^4 + 4x^3 + x^2$	Simplify.

(3)

SOLUTION 1.2 1.2.1

Steps	Explanation
$\frac{4p^2 + 4p}{4p} \times \frac{p-1}{1}$	Identify as an algebraic expression.
$= \frac{4p(p+1)}{4p} \times \frac{p-1}{1}$	Factorise by taking out $4p$ as a common factor.
$= (p + 1)(p - 1)$	Simplify.
$= p^2 - 1$	FOIL the brackets and simplify.

(3)

SOLUTION 1.2.2

Steps	Explanation
$(-2x + 3)(x^2 + 3x - 8)$	Identify the algebraic expression as a two term multiply by a three term. You need to remove the brackets.
$= -2x^3 - 6x^2 + 16x + 3x^2 + 9x - 24$	Use the distribution law.
$= -2x^3 - 3x^2 + 25x - 24$	Simplify.

(3)

SOLUTION 1.3 1.3.1

Steps	Explanation
$(r + s - 1)(r + s)$	Identify the algebraic expression as a three term and multiply by a two term.
$= r^2 + rs + rs + s^2 - r - s$	Use the distribution law. Find the product of the two binomials.
$= r^2 + s^2 + 2rs - r - s$	Use FOIL and simplify.

(2)

SOLUTION 1.3.2

Steps	Explanation
$(p^3 - 1)^2 - 3p^3(p^3 + 2) - 6p^6$	Identify the algebraic expression and you need to remove the brackets.
$= p^6 - 2p^3 + 1 - 3p^6 - 6p^3 - 6p^6$	Use FOIL to simplify the first term and the distribution rule to simplify the second term.
$= -8p^6 - 8p^3 + 1$	Simplify.

(3)

SOLUTION 1.3.3

Steps	Explanation
$(a^3)^2 \times a^4$	Simplify the expression by applying the exponential law: $(a^m)^n = a^{m \times n}$
$= a^6 \times a^4$	Apply the exponential law: $a^m \times a^n = a^{m+n}$
$= a^{10}$	Simplify.

(2)

SOLUTION 1.4 1.4.1

Steps	Explanation
$(p + q - 1)(p + q)$	Identify the algebraic expression as a three term and multiply by a three term. You need to remove the brackets.
$= pp^2 + pq + pq + q^2 - p - q$	Use the distribution law.
$= p^2 + q^2 + 2pq - p - q$	Simplify.

(3)

SOLUTION 1.4.2

Steps	Explanation
$(a^3 - 1)^2 - 3a^3(a^3 + 2) - 6a^6$	Identify the algebraic expression as a three term and multiply by a three term. You need to remove the brackets.
$= a^6 - 2a^3 + 1 - 3a^6 - 6a^3 - 6a^6$	Use the distribution law.
$= -8a^6 - 8a^3 + 1$	Simplify.

(3)

SOLUTION 1.4.3

Steps	Explanation
$(x^3)^2 \times x^4$	Identify the algebraic expression with exponents.
$= x^6 \times x^4$	Apply the exponential law: $(a^m)^n = a^{m \times n}$
$= x^{10}$	Apply the exponential law: $a^m \times a^n = a^{m+n}$

(2)

SOLUTION 1.5

Steps	Explanation
C	

(1)

SOLUTION 1.6 1.6.1

Steps	Explanation
$(a + b)^2$	Identify as the product of two binomials. Use the distribution law to find the product.

(1)

SOLUTION 1.6.2

Steps	Explanation
$(x - 3y)(x^2 + 3xy + 9y^2)$	Identify the algebraic expression as a two term multiply by a three term. You need to remove the brackets.
$= x^3 + 3x^2y - 3x^2y + 9xy^2 - 9xy^2 - 27y^3$	Use the distribution law.
$= x^3 - 27y^3$	Simplify.

(2)

SOLUTION 1.7 1.7.1

Steps	Explanation
$4x^2 - 9$	Simplify.

(1)

SOLUTION 1.7.2

Steps	Explanation
$(x^2 + y)(4x + 3xy + x^{-1}y^2)$	Identify the algebraic expression as a two term multiply by a three term. You need to remove the brackets.
$= 4x^3 + 3x^3y + xy^2 + 4xy + 3xy^2 + x^{-1}y3$	Use the distribution law.
$= 4x^3 + 3x^3y + 4xy + x^{-1}y^3$	Simplify.

(2)

SOLUTION 1.8

Steps	Explanation
$\frac{63x^2y - 7x^2y^3}{7x^2y}$	Identify the algebraic expression as a two term divided by a monomial.
$= 9 - y^2$	Simplify.

(2)

SOLUTION 1.9

Steps	Explanation
$\frac{6x^3y^2 + 21x^2 + 18xy^2}{18xy^2}$	Identify the algebraic expression as a three term divided by a monomial.
$= \frac{3xy^2(2x^2 + 7x + 6)}{18xy^2}$	Take out the HCF.
$= \frac{(2x^2 + 7x + 6)}{6}$	Cancel out.
$= \frac{(x + 2)(2x + 3)}{6}$	Factorise the numerator.

(3)

QUESTION 2: Factorisation

SOLUTION 2.1 2.1.1

Steps	Explanation
$3pqx + pqy - 12x - 4y$	Identify as an algebraic expression with four terms.
$= 3pqx + pqy - (12x + 4y)$	Regroup the terms.
$= (pq - 4)(3x + y)$	Factorise.

(3)

SOLUTION 2.1.2

Steps	Explanation
$-64k^2 + 100$	Identify as an algebraic expression with two terms and two square numbers.
$= -4(16k^2 - 25)$	Take out a minus 4 as a common factor.
$= -4(4k - 5)(4k + 5)$	Factorise as the difference between two squares.

(3)

SOLUTION 2.2 2.2.1

Steps	Explanation
$9a^2 - b^2$	Identify as an algebraic expression with two terms and two square numbers.
$= (3a - b)(3a + b)$	Factorise as the difference between two squares.

(2)

SOLUTION 2.2.2

Steps	Explanation
$-a^2 - a + 2$	Identify as an algebraic expression with three terms.
$= -(a^2 + a - 2)$	Take out a minus as a common factor.
$= -(a + 2)(a - 1)$	Factorise.

(3)

SOLUTION 2.2.3

Steps	Explanation
$2ab - 2a^2 + a - b$	Identify as an algebraic expression with four terms.
$= -2a(a - b) + (a - b)$	Regroup the terms and take out a minus 2*a* as a common factor out of first two terms.
$= (a - b)(-2a + 1)$	Factorise by taking out a common bracket.

(3)

SOLUTION 2.3 2.3.1

Steps	Explanation
$2 - 32p^2$	Identify as an algebraic expression with two terms and a minus between the two terms.
$= 2(1 - 16p^2)$	Take out 2 as a common factor.
$= 2(1 - 4p)(1 + 4p)$	Factorise as the difference between two squares.

(2)

SOLUTION 2.3.2

Steps	Explanation
$6(p - q) + 9p(q - p)$	Identify as an algebraic expression with two terms.
$= 6(p - q) - 9p(p - q)$	Do a sign change.
$= (6 - 9p)(p - q)$	Factorise by taking out a common bracket.
$= 3(2 - 3p)(p - q)$	Factorise by taking out a common factor.

(4)

SOLUTION 2.4 2.4.1

Steps	Explanation
$2 - 32a^2$	Identify as an algebraic expression with two terms and a minus sign.
$= 2(1 - 16a^2)$	Take out 2 as a common factor.
$= 2(1 - 4a)(1 + 4a)$	Factorise as the difference between two squares.

(2)

SOLUTION 2.4.2

Steps	Explanation
$12(a - b) + 18a(b - a)$	Identify as an algebraic expression with two terms.
$= 12(a - b) - 18a(a - b)$	Change sign.
$= (12 - 18a)(a - b)$	Switch around.
$= 6(2 - 3a)(a - b)$	Factorise by taking out a common factor.

(4)

SOLUTION 2.5 2.5.1

Steps	Explanation
$9x^3 - 16xy^2$	Identify as a binomial algebraic expression.
$= x(9x^2 - 16y^2)$	Take out x as a common factor. It is the HCF.
$= x(3x - 4y)(3x + 4y)$	Factorise as the difference between squares. Check your answer.

(2)

SOLUTION 2.5.2

Steps	Explanation
$6x - 9 + 6xy - 9y$	Identify the algebraic expression as a four term. We usually use grouping to factorise the expression.
$= 6x + 6xy + (-9 - 9y)$	Rearrange the terms so that the similar terms are together.
$= 6x(1 + y) - 9(1 + y)$	Take out the common factors. Work with strategy as you want a common bracket.
$= (1 + y)(6x - 9)$	Take out a common bracket.
$= 3(1 + y)(2x - 3)$	Take out 3 as a common factor.

(2)

SOLUTION 2.5.3

Steps	Explanation
$4a^2 - 4a + 1$	Identify the algebraic expression as a quadratic trinomial.
$= (2a - 1)(2a - 1)$	Factorise the trinomial and check the signs.

(2)

SOLUTION 2.6 2.6.1

Steps	Explanation
$20 - 45y^2$	Identify as a binomial algebraic expression. Note the minus sign.
$= 5(4x^2 - 9y^2)$	Take out 5 as a common factor. Work with strategy and identify the square numbers left inside the brackets.
$= 5(2x - 3y)(2x + 3y)$	Factorise as the difference between squares. Check your answer.

(2)

SOLUTION 2.6.2

Steps	Explanation
$2x^2 - 5x - 3$	Identify the algebraic expression as a quadratic trinomial.
$= (2x + 1)(x - 3)$	Factorise as the difference between squares. Check your answer.

(2)

SOLUTION 2.6.3

Steps	Explanation
$(5x^2 - 15) + (12y - 4xy)$	Identify the algebraic expression as a four term and the terms are brackets.
$= 5x(x - 3) + 4y(3 - x)$	Take out the common factors out of each set of brackets. Work with strategy as you want a common bracket.
$= 5x(x - 3) - 4y(x - 3)$	Do a sign switch to get the brackets the same.
$= (5x - 4y)(x - 3)$	Factorise by taking out a common bracket.
Alternate	
$(5x^2 - 4xy) + (-15x + 12y)$	Rearrange the terms.
$= x(5x - 4y) + 3(-5x + 4y)$	Take out the common factors out of each set of brackets. Work with strategy as you want a common bracket.
$= x(5x - 4y) - 3(5x - 4y)$	Do a sign switch to get the brackets the same.

(3)

QUESTION 3: Solve algebraic equations

SOLUTION 3.1 3.1.1

Steps	Explanation
$32^{x-1} = 64^{2x-1}$	Identify it as an exponential equation and you need to solve for *x*.
$(2^5)^{x-1} = (2^6)^{2x+1}$	Rewrite $2^5 = 32$ and $2^6 = 64$. Focus on getting the bases the same.
$2^{5x-1} = 2^{12x-6}$	Use exponential rules and remove the brackets.
$5x - 5 = 12x + 6$	We drop the bases. If the bases on both sides of an exponential equation are equal, then the exponents must also be equal.
$-5 - 6 = 12x - 5x$	Get the numbers on one side and the terms with an *x* on the other sides.
$7x = -11$	Simplify.
$x = -\frac{11}{7}$	Isolate the *x*-value.

(4)

SOLUTION 3.1.2

Steps	Explanation
$-2x - 2 = -3(-2x - 1)$	Identify it as a linear algebraic equation and you need to solve for *x*.
$-2x - 2 = 6x + 3$	Use the distribution law and remove the brackets. Note the effect of the minus sign.
$-2 - 3 = 6x + 2x$	Get the numbers on one side and the terms with an *x* on the other sides.
$-5 = 8x$	Simplify.
$x = -\frac{5}{8}$	Isolate the *x*-value.

(3)

SOLUTION 3.2

Steps	Explanation
$4.3^{x-3} = 108$	Identify it as an exponential equation and you need to solve for *x*.
$3^{x-3} = 27$	Get rid of the 4 by dividing the other side.
$3^{x-3} = 3^3$	Rewrite $3^3 = 27$. Focus on getting the bases the same.
$x - 3 = 3$	We dropped the bases. If the bases on both sides of an exponential equation are equal, then the exponents must also be equal.
$x = 6$	Isolate the *x*-value.

(3)

SOLUTION 3.3 3.3.1

Steps	Explanation
$p^{3x-6} = 1$	Identify it as an exponential equation and you need to solve for *x*.
$p^{3x-6} = p^0$	Rewrite $2^5 = 32$ and $2^6 = 64$. Focus on getting the bases the same.
$3x - 6 = 0$	We dropped the bases. If the bases on both sides of an exponential equation are equal, then the exponents must also be equal.
$3x = 6$	Isolate the *x*-value.
$x = 2$	Simplify.

(2)

SOLUTION 3.3.2

Steps	Explanation
$\frac{x+4}{2} = \frac{2x+7}{3}$	Identify it as an algebraic equation with fractions and you need to solve for *x*.
$3(x + 4)=2(2x + 7)$	Cross-multiply the denominators. Your aim is to flatten the equation. You get rid of the fractions.
$3x + 12 = 4x + 14$	Use the distribution law and remove the brackets.
$3x - 4x = 14 - 12$	Get the numbers on one side and the terms with an *x* on the other sides.
$-x = 2$	Simplify.
$x = -2$	Isolate x.

(3)

SOLUTION 3.4 3.4.1

Steps	Explanation
$a^x = 1$	Identify it as an exponential equation and you need to solve for *x*.
$a^x = a^0$	Rewrite $a^0 = 1$. Focus on getting the bases the same.
$x = 0$	We dropped the bases. If the bases on both sides of an exponential equation are equal, then the exponents must also be equal.

(2)

SOLUTION 3.4.2

Steps	Explanation
$\frac{x}{2} = \frac{x-3}{4}$	Identify it as an algebraic equation with fractions and you need to solve for *x*.
$4x = 2(x - 3)$	Cross-multiply the denominators. Your aim is to flatten the equation. You get rid of the fractions.
$4x = 2x - 6$	Use the distribution law and remove the brackets.
$2x = -6$	Get the numbers on one side and the terms with an *x* on the other sides.
$x = -3$	Simplify.

(3)

SOLUTION 3.5 3.5.1

Steps	Explanation
$x - (x - 2) + 2(3 - x) = 0$	Identify it as an algebraic equation and you need to solve for *x*.
$x - x + 2 + 6 - 2x = 0$	Use the distribution law and remove the brackets.
$8 = 2x$	Get the numbers on one side and the terms with an *x* on the other sides.
$x = 4$	Isolate *x*.

(2)

SOLUTION 3.5.2

Steps	Explanation
$\frac{x+2}{5} - 5 = -\frac{1-3x}{3}$	Identify it as an algebraic equation with fractions and you need to solve for *x*.
$3(x + 2) - 5(15) = -5(1 - 3x)$	Multiply every term with the LCM. LCM = 15.
$3x + 6 - 75 = -5 + 15x$	Use the distribution law and remove the brackets.
$3x - 69 = -5 + 15x$	Get the numbers on one side and the terms with an *x* on the other sides.
$-12x = 64$	Simplify.
$x = -\frac{-16}{3}$	Isolate *x*.

(3)

SOLUTION 3.5.3

Steps	Explanation
$(2^{x+1})^2 = (2^2)^3$	Identify it as an exponential equation and you need to solve for *x*.
$2^{2x+2} = 2^6$	Apply exponential rules and remove the brackets.
$2x + 2 = 6$	We dropped the bases. If the bases on both sides of an exponential equation are equal, then the exponents must also be equal.
$2x = 4$	Simplify.
$x = 2$	Isolate *x*.

(2)

SOLUTION 3.6 3.6.1

Steps	Explanation
$\frac{2}{x} = \frac{-4}{x+5}$	Identify it as an algebraic equation with fractions and you need to solve for *x*.
$2(x + 5) = -4x$	Multiply every term with the LCM. LCM = $x(x + 5)$.
$2x + 10 = -4x$	Use the distribution law and remove the brackets.
$6x = -10$	Simplify.
$x = -\frac{10}{6}$	Isolate *x*.

(2)

SOLUTION 3.6.2

Steps	Explanation
$x^2 - 6x + 9 = x - 1$	Identify it as a quadratic and you need to solve for *x*.
$x^2 - 7x + 10 = 0$	Write the quadratic trinomial in standard form.
$(x - 5)(x - 2) = 0$	Factorise the quadratic trinomial.
$\therefore x = 5$ or $x = 2$	Isolate *x*.

(2)

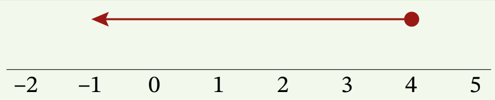
SOLUTION 3.6.3

Steps	Explanation
$27^{x+1} = 9^{x-2}$	Identify it as an exponential equation and you need to solve for *x*.
$(3^3)^{x+3} = (3^2)^{x-2}$	Rewrite the bases with a prime base.
$3^{3x+3} = 3^{2x-4}$	Apply exponential rules and remove the brackets.
$3x + 3 = 2x - 4$	We dropped the bases. If the bases on both sides of an exponential equation are equal, then the exponents must also be equal.
$x = -7$	Isolate *x*.

(3)

QUESTION 4: Solve linear inequalities

SOLUTION 4.1

Steps	Explanation
$4(x + 1) \leq 3x + 8$	Identify it as a linear inequality.
$4x + 4 \leq 3x + 8$	Use the distribution law and remove the brackets.
$4 \leq -x + 8$	Simplify.
$-4 \leq -x$	Isolate x.
$4 \geq x$ or $x \leq 4$	Switch the inequality sign.
	Draw the number line. Note it is a closed dot.

(4)

SOLUTION 4.2

Steps	Explanation
$2(3x - 1) > 4x + 5$	Identify it as a linear inequality x.
$6x - 2 > 4x + 5$	Use the distribution law and remove the brackets.
$2x > 7$	Simplify.
$x > \frac{7}{2}$	Isolate x.

(3)

SOLUTION 4.3

Steps	Explanation
$3x - 2 \leq 2x + 6$	Identify it as a linear inequality.
$3x \leq 2x + 8$	Get the numbers on one side and the terms with an x on the other sides.
$3x - 2x \leq 8$	Simplify.
$x \leq 8$	Isolate x.

(2)

SOLUTION 4.4 4.4.1

Steps	Explanation
$A_T = A_0 + A_0 \times \frac{r \times t}{100}$	Identify the literal equation.
$A_T = A_0\left(1 + \frac{r \times t}{100}\right)$	Factorise by taking out A_0 as the HCF.
$\therefore A_0 = \frac{A_T}{1 + \frac{r \times t}{100}}$	Isolate A_0

(2)

SOLUTION 4.4.2

Steps	Explanation
$A_0 = \frac{3\ 000}{1 + \frac{5 \times 4}{100}}$	Substitute the values into the manipulated formula.

(1)

SOLUTION 4.5 4.5.1

Steps	Explanation
$4 \geq 3 - 8x > -11$	Identify it as a linear inequality and you need to solve for x.
$1 \geq -8x > -14$	Simplify.
$0{,}25 \leq x < 1{,}75$	Switch the inequality sign as we divide by a negative.

(3)

SOLUTION 4.5.2

Steps	Explanation
$x \in [-0{,}25; 1{,}75)$ for $x \in R$	The domain is the set of all input values (x) for which the function is defined, excluding values that cause issues like division by zero or square roots of negatives.

(1)

SOLUTION 4.6

Steps	Explanation
C	Look at the closed dot and the open dot.

(1)

SOLUTION 4.7

Steps	Explanation
$A_t = A_0(1 + rt)$	This is a formula and you need to get *t* alone,
$\frac{A_t}{A_0} - 1 = rt$	Start furthest away from the subject.
$t = \frac{\frac{A_t}{A_0} - 1}{r}$	Isolate *t*.
$t = \frac{\frac{2\,625}{1\,500} - 1}{\frac{15}{100}}$	Substitute the values into the *n* = manipulated formula.
= 5 years	Simplify.

(3)

SOLUTION 4.8 4.8.1

Steps	Explanation
$6 - 5x \geq 4x - 9$	Identify it as a linear inequality and you need to solve for *x*.
$-9x \geq -15$	Simplify.
$x \leq \frac{15}{9}$	Switch the inequality sign as we divide by a negative.
$x \leq \frac{5}{3}$	Simplify.

(2)

SOLUTION 4.8.2

Steps	Explanation
Show the inequality on a number line.	Show the solution on a number line.

(1)

QUESTION 5: Solve simultaneous equations

SOLUTION 5.1

Steps		Explanation
$2x - y = 3$ and $3x - 2y = 1$		Identify it as a simultaneous equation and you need to solve for x and y.
$2x - y = 3$	(A)	State the one linear equation and name it A.
$3x - 2y = 1$	(B)	State the other linear equation and name it B.
$y = 2x - 3$	(C)	From A get y alone.
$3x - 2(2x - 3) = 1$		Equate the two equations.
$-x = -5$		Simplify.
$x = 5$		Solve for x.
$y = 2(5) - 3$		Substitute $x = 5$ into (C).
$y = 7$		Solve for y.

(4)

SOLUTION 5.2

Steps		Explanation
$y = -2x + 4$	(A)	State the one linear equation and name it A.
$y = 2x + 8$	(B)	State the other linear equation and name it B.
$-2x + 4 = 2x + 8$		Equate the two equations.
$-4x = 4$		Simplify.
$x = -1$		Solve for x.
$y = -2(-1) + 4$		Substitute $x = -1$ in (A).
$y = 6$		Solve for y.

(4)

SOLUTION 5.3

Steps		Explanation
$4x - 1 = y$	(A)	State the one linear equation and name it A.
$-x + 1 = y$	(B)	State the other linear equation and name it B.
$4x - 1 = -x + 1$		Let equation (A) = equation (B).
$5x = 2$		Simplify.
$x = \frac{2}{5}$		Solve for x.
$4\left(\frac{2}{5}\right) - 1 = y$		Substitute $x = \frac{2}{5}$ in (A).
$y = 0{,}6$		Solve for y.

(4)

SOLUTION 5.4

Steps		Explanation
$x + 2y - 1 = 0$	(A)	State the one linear equation and name it A.
$x - 2y + 3 = 0$	(B)	State the other linear equation and name it B.
$x + 2y = 1$		Rearrange equation (A).
$x - 2y = -3$		Rearrange equation (B).
$x + 2y = x - 2y - 3$		Let equation (A) = equation (B).
$4y = -4$		Simplify.
$y = -1$		Solve for y.
$x + 2(-1) = 1$		Substitute $y = -1$ into (A).
$x - 2 = 1$		Simplify.
$x = 3$		Solve for x.

(4)

SOLUTION 5.5

Steps		Explanation
$2x = 3y - 4$	(A)	State the one linear equation and name it A.
$y = x - 3$	(B)	State the other linear equation and name it B.
$2x = 3(x - 3) - 4$		Substitute B into equation A.
$2x = 3x - 9 - 4$		Simplify.
$-x = -13$		Simplify.
$x = 13$		Solve for x.
$y = 13 - 3$		Substitute $x = 13$ in equation B.
$y = 10$		Solve for y.

(3)

SOLUTION 5.6

Steps		Explanation
$2x - y = 7$	(A)	State the one linear equation and name it A.
$3x + 2y = 28$	(B)	State the other linear equation and name it B.
$y = 2x - 7$	(C)	Make y the subject of equation A.
$3x + 2(2x - 7) = 28$		Substitute equation C into equation B.
$3x + 4x - 14 = 28$		Simplify.
$7x = 42$		Simplify.
$x = 6$		Solve for x.
$y = 2(6) - 7$		Substitute $x = 6$ in equation C.
$y = 5$		Solve for y.

(3)

Question papers Maths L2

Introduction to Paper 1 and Paper 2

Proposed mark distribution between Paper 1 and Paper 2 for external examination papers

Paper 1	
Topics	**Marks**
1. Numbers	30
2. Functions and Algebra	
2.1 Functions	25
2.2 Algebra	25
5. Financial Mathematics	20
Total	**100**

Paper 2	
Topics	**Marks**
3. Space, Shape and Measurement	
3.1 Geometry	30
3.2 Trigonometry	30
4. Data Handling	40
Total	**100**

Formula sheets

Paper 1

Paper 2

Chapter 3: **Space, shape and measurement** (Paper 2)

Part 1: Geometry

QUESTION 1: Perimeters, areas and volumes

SOLUTION 1.1 1.1.1

Steps	Explanation
SA = $2\pi rh + 2\pi r^2$	Write down the surface area of a cylinder.
$= 24\pi + 4{,}5\pi$	Substitute the values into the formula.
$= 28{,}5\pi$ cm^2 $= 89{,}535$ cm^2	

(3)

SOLUTION 1.1.2

Steps	Explanation
$V_{\text{WHOLE BEAM}} = l \times w \times h$	Write down the volume for rectangular prism.
$= 12 \times 8 \times 6$	Substitute the values into the formula.
$= 576$ cm^3	
$V_{\text{WHOLE CYLINDER}} = \pi r^2 h$	Write down the volume of a cylinder.
$= \pi\left(\frac{3}{2}\right)^2 \times 8$	Substitute the values into the formula.
$= \pi \times \frac{9}{4} \times 8$	Simplify.
$= 18\pi$ cm^3	Simplify.
$= 56{,}549$ cm^3	Use your calculator to determine volume.
Total volume = 576 + 56,549 + 56,549	Add the volumes.
Total volume = 689,098 cm^3	Insert the cubic units.

(7)

SOLUTION 1.2 1.2.1

Steps	Explanation
Area of the circular plate = $\pi \times (r)^2$	Write down the formula for area of a plate.
Area = $\pi \times 2^2$	Substitute the values into the formula.
Area = 12,566 cm^2	Use a calculator and simplify.

(2)

SOLUTION 1.2.2

Steps	Explanation
Area of square = $s^2 = (2)^2$ $= 4$ cm^2	Use the area formula for a square. Substitute the length of the side into the formula.
Area of square = $s^2 = (3)^2$ $= 9$ cm^2	Use the area formula for a square. Substitute the length of the side into the formula.

(4)

SOLUTION 1.2.3

Steps	Explanation
Area of rectangular plate = $l \times b$ Area = 12 × 8 = 96 cm^2	Use the area formula for a rectangle.
Area of the plate after cutting squares and circle	
= 96 – (12,566 + 4 + 9)	Find the difference.
= 70,434 cm^2	Use a calculator and simplify.

(3)

SOLUTION 1.3

Steps	Explanation
Volume = area of triangle × height	Identify the shape as triangular prism.
Volume = $\frac{1}{2} \times 15 \times 25 \times 10$	Substitute the dimensions of the prism into the formula.
Volume = 1 875 cm^2	Calculate the volume and insert the cm^3.

(4)

SOLUTION 1.4 1.4.1

Steps	Explanation
A = 2(20 × 30) + 2(50 × 30) + (50 × 20)	Substitute the values into the formula.
= 5 200 cm^2	Insert the square units.

(4)

SOLUTION 1.4.2

Steps	Explanation
$SA = 2\pi r(h + r)$	Write down the formula for surface area of a cylinder.
$SA = 2\pi(2,5)(10 + 2,5)$	Substitute the values into the formula.
SA = 196,35 cm^2	Insert the square units.

(3)

SOLUTION 1.4.3

Steps	Explanation
$V_{tank} = 50 \times 20 \times 30 = 30\,000\ cm^3$	Substitute the values into the rectangular prism formula.
$V_{cylinder} = \pi(2,5)^2 \times 10$	Substitute the values into the formula.
$V_{cylinder} = 196,35\ cm^3$	Use your calculator to determine the volume.
$V_{new} = 30\,000 - 196,35$	Subtract the volumes.
$V_{new} = 29\,803,65\ cm^3$	Simplify.

(5)

SOLUTION 1.5 1.5.1

Steps	Explanation
Length of BC = $\sqrt{(2 - (-1))^2 + (2 - 2)^2}$	Substitute the values into the formula.
BC = 3	

(3)

SOLUTION 1.5.2

Steps	Explanation
Midpoint of AC = $\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$	Write down the formula to determine the midpoint of a line segment AC.
Midpoint of AC = $\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$	Simplify.

(2)

SOLUTION 1.5.3

Steps	Explanation
Gradient of AB = $\frac{-1-2}{2-(-1)}$ AB = $\frac{-3}{3}$ = –1	Substitute the values into the formula.
AB = –1	Simplify.

(2)

SOLUTION 1.6 1.6.1

Steps	Explanation
Area of semi-circle = $\frac{1}{2}\pi r^2$	Identify the shape of the vegetable garden as a semi-circle.
Area of semi-circle = $\frac{1}{2}\pi(4)^2$	Substitute the radius into the formula. Note radius = $\frac{\text{diameter}}{2}$
Area of semi-circle = 8π	Simplify.
Area of semi-circle = 25,133 m^2	Use your calculator to determine the area. Insert the m^2.

(3)

SOLUTION 1.6.2

Steps	Explanation
Perimeter of the vegetable garden = $0{,}5(2\pi r)$ + diameter	Write down the formula for perimeter of a rectangle.
= $0{,}5(2\pi \times 4) + 8$	Substitute the values into the formula.
= 20,566 m	Insert the units.

(3)

SOLUTION 1.6.3

Steps	Explanation
Whole metres for fencing: 21 m	Determine the length required for the fence.
Cost = 290 × 21	Multiply length by the cost per metre.
= R6 090	Check if the amount is reasonable.

(2)

SOLUTION 1.7 1.7.1

Steps	Explanation
Surface area of the cylinder $= 2\pi r\ (h + r)$	Write down the formula for surface area of a cylinder.
$= 2\pi(3{,}5)(11 + 3{,}5)$	Substitute the values into the formula.
$= 318{,}872\ cm^2$	Check if the area is reasonable. Insert the squared units.

(3)

SOLUTION 1.7.2

Steps	Explanation
Volume of the cylinder $= \pi r^2 h$	Write down the formula for volume of a cylinder.
$= \pi(3{,}5)^2 11$	Substitute the values into the formula.
$= 423{,}330\ cm^3$	Insert the cubic units.

(2)

SOLUTION 1.8 1.8.1

Steps	Explanation
Volume of a cube $= s^3$	Write down the formula for volume of a cube.
$= 21^3$	Substitute the values into the formula.

(2)

SOLUTION 1.8.2

Steps	Explanation
Surface area of a cube $= 6s^3$	Write down the formula for surface area of a cube.
$= 6 \times 21^2$	Substitute the values into the formula.
$= 2\ 646\ cm^2$	Insert the units.

(2)

SOLUTION 1.9

Steps	Explanation
Volume of cylinder $= \pi \times r^2 \times h$	Write down the volume of a cylinder.
$= \pi \times 3^2 \times 10$	Substitute the values into the formula.
= 282,743 cm^3	Insert the units.
Volume of square hole = $l \times b \times h$	Write down the formula for volume.
$= 4 \times 4 \times 10$	Substitute the values into the formula.
= 160 cm^3	Insert the units.
Volume of steel = 282,74 – 160	Get the volume of steel by subtracting in the volumes
= 122,743 cm^3	Simplify and insert the unit.

(3)

SOLUTION 1.10

Steps	Explanation
$P = 2(l + b)$	Use the perimeter formula for a rectangle.
42 cm = 2(l + 10 cm)	Substitute the perimeter and the length into the formula.
21 cm = l + 10 cm	Divide 42 by 2.
l = 11 cm	Get the length and insert the unit.

(4)

SOLUTION 1.11 1.11.1

Steps	Explanation
Radius = 0,6 ÷ 2 = 0,3 m	The radius is half the diameter.

(1)

SOLUTION 1.11.2

Steps	Explanation
Circumference $= \pi \times d$	Write down the formula for circumference of a circle.
$= \pi \times 0{,}6$ m	Substitute the diameter into the formula.
$= 1{,}885$ m	Use your calculator to simplify it. Insert the unit.
Alternate method	
Circumference $= 2\pi r$	Write down the formula for circumference of a circle.
$= 2\pi(0{,}3)$	Substitute the values into the formula.
$= 1{,}885$ m	Insert the unit.

(2)

SOLUTION 1.11.3

Steps	Explanation
Volume = area × perpendicular height	The base of a cylinder is a circle. Multiply by height.
$= \pi \times r^2 \times h$	Use the formula for the volume of a cylinder.
$= \pi \times 0{,}3^2 \times 0{,}142$	Substitute the radius and height into the formula.
$= 0{,}041$ m^3	Insert the cubic units.
$= 0{,}040$ m^3	Round off to two decimal places.

(3)

QUESTION 2: Use the coordinate system to derive and apply equations

SOLUTION 2.1 2.1.1

Steps	Explanation
$DC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	Use the distance formula between two coordinates.
$DC = \sqrt{(3 - (-1))^2 + (5 - 2)^2}$	Substitute the values into the formula.
$DC = \sqrt{(4)^2 + (3)^2}$	Simplify.
$DC = 5$	Simplify.

(3)

SOLUTION 2.1.2

Steps	Explanation
$DC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	Write down the length formula.
$DC = \sqrt{(3 - 4)^2 + (5 - 2)^2}$	Substitute the coordinates.
$DC = \sqrt{(-1)^2 + (3)^2}$	Simplify inside the brackets.
$DC = \sqrt{10}$	Keep answer in surd form.

(3)

SOLUTION 2.1.3

Steps	Explanation
Midpoint $= \left(\frac{x_2 + x_1}{2} ; \frac{y_2 + y_1}{2}\right)$	Write down the length formula.
Midpoint $= \left(\frac{-1 + 3}{2} ; \frac{2 + 5}{2}\right)$	Substitute the coordinates.
Midpoint $= \left(1 ; \frac{7}{2}\right)$	Simplify inside the brackets.

(3)

SOLUTION 2.1.4

Steps	Explanation
$m = \frac{y_2 - y_1}{x_2 - x_1}$	Write down the gradient formula.
$m = \frac{5 - 2}{3 - (-1)}$	Substitute the coordinates.
$m = \frac{3}{4}$	Simplify.
$m = \tan \theta$ $\frac{3}{4} = \tan \theta$	Write down the angle of inclination. Substitute the gradient.
$\theta = \tan^{-1}\frac{3}{4} = 36{,}87°$	Find the arc of the trigonometric function. The angle θ is measured in degrees.

(5)

SOLUTION 2.2 2.2.1

Steps	Explanation
$AB = \sqrt{(9 - 4)^2 + (1 - 4)^2}$	Use the formula $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$= \sqrt{25 + 9}$	Simplify inside the brackets.
$= \sqrt{34}$	Apply BODMAS and simplify under the root.
= 5,83 units	Use your calculator and find the distance.

(3)

SOLUTION 2.2.2

Steps	Explanation
Midpoint of BC = $\left(\frac{x_2 - x_1}{2}; \frac{y_2 - y_1}{2}\right)$	Write down the formula to determine the midpoint of a line segment BC.
Midpoint M = $\left(\frac{7 + 9}{2}; \frac{-2 + 1}{2}\right)$	Substitute the values B(9; 1) and C(7; –2) into the midpoint formula.
Midpoint M = $\left(\frac{16}{2}; \frac{-1}{2}\right)$	Simplify.
Midpoint M = $\left(8; -\frac{-1}{2}\right)$	Write the midpoint of BC as a set of coordinates.

(2)

SOLUTION 2.2.3

Steps	Explanation
$m_{CD} = \frac{-2-0}{7-3}$	Use the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$
$m_{CD} = -\frac{1}{2}$	Write in the form $y = mx + c$

(2)

SOLUTION 2.2.4

Steps	Explanation
$m_{BC} = \frac{-2-1}{7-9} = \frac{3}{2}$	Use the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$
$y = \frac{3}{2}x + c$	Simplify inside the brackets.
At point B	
$c = 1 - \frac{3}{2}(9)$	Substitute the values.
$= -\frac{25}{2}$	Simplify.
Equation of BC	
$y = \frac{3}{2}x - \frac{25}{2}$	Write in the form $y = mx + c$

(4)

SOLUTION 2.3 2.3.1

Steps	Explanation
$AC = \sqrt{(-3-1)^2 + (-1-4)^2}$	Use the formula $AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$AC = \sqrt{16 + 25}$	Simplify inside the brackets.
$AC = \sqrt{41}$	Apply BODMAS and simplify under the root.
AC = 6,4 units	Use your calculator and find the distance.

(3)

SOLUTION 2.3.2

Steps	Explanation
$m_{CD} = \frac{-4-4}{1-9}$	Use the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$
$m_{CD} = 1$	Simplify.

(2)

SOLUTION 2.3.3

Steps	Explanation
$M_{BC} = \left(\frac{9+1}{2}; \frac{4-4}{2}\right)$	Substitute the values into the formula.
M = (5; –0)	The *y*-coordinate is 0, therefore the line lies on the *x*-axis.

(4)

SOLUTION 2.3.4

Steps	Explanation
$m_{AB} = \frac{4-(-1)}{9-(-3)} = \frac{5}{12}$	Find the gradient.
$y = \frac{5}{12}x + c$	Substitute the values into the formula.
At point B	Substitute the values into the formula.
$c = 4 - \frac{5}{12}(9)$	Simplify.
$c = \frac{1}{4}$	Simplify.
Equation of AB	
$y = \frac{5}{12}x - \frac{1}{4}$	Substitute into the straight line formula.

(4)

SOLUTION 2.4 2.4.1

Steps	Explanation
$E = \left(\frac{7+5}{2}; \frac{-2+2}{2}\right)$	Use the midpoint formula $E = \left(\frac{x_2+x_1}{2}; \frac{y_2+y_1}{2}\right)$
E = (–1; 0)	Simplify.

(2)

SOLUTION 2.4.2

Steps	Explanation
Distance BC = $(x_2 - x_1)^2 + (y_2 - y_1)^2$	Use the distance formula between two coordinates.
$= (-3-5)^2 + (6-2)^2$	Substitute the values into the formula.
$= (-8)^2 + (4)^2$	Simplify.
$= \sqrt{80}$	Simplify.
$= 4\sqrt{5}$	We usually leave the answer in surd form.

(3)

SOLUTION 2.4.3

Steps	Explanation
$m = \frac{y_2 - y_1}{x_2 - x_1}$	Write down the formula for the gradient of a line.
$m = \frac{2 - 6}{5 - (-3)}$	Substitute the values B(–3; 6) and C(5; 2) into the gradient formula.
$m = \frac{-4}{5 + 3}$	Simplify the denominator.
$m = \frac{-4}{8}$	Simplify.
$m = -\frac{1}{2}$	Simplify the fraction.

(3)

SOLUTION 2.5 2.5.1

Steps	Explanation
$PQ = \sqrt{(-2 - 5)^2 + (5 - 3)^2}$	Use the distance formula between two coordinates.
$PQ = \sqrt{25 + 4}$	Substitute the values into the distance formula and simplify.
$PQ = \sqrt{29}$	Apply BODMAS and simplify under the root sign.
$QR = \sqrt{(3 - 1)^2 + (3 + 2)^2}$	Substitute the values into the formula.
$QR = \sqrt{4 + 25}$	Apply BODMAS and simplify the brackets first.
$QR = \sqrt{29}$	Simplify under the root sign.
$PR = \sqrt{(-2 - 1)^2 + (5 + 2)^2}$	Substitute the values into the formula.
$PR = \sqrt{9 + 49}$	Apply BODMAS and simplify the brackets first.
$PR = \sqrt{58}$	Apply BODMAS and simplify under the root sign

(6)

SOLUTION 2.5.2

Steps	Explanation
Midpoint PQ = $\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$	Write down the formula to determine the midpoint of a line segment PQ.
Midpoint PQ = $\left(\frac{3 + (-2)}{2}; \frac{3 + 5}{2}\right)$	Substitute the values P(–2; 5) and Q(3; 3) into the midpoint formula.
Midpoint PQ = $\left(\frac{1}{2}; \frac{8}{2}\right)$	Simplify.
Midpoint PQ = $\left(\frac{1}{2}; 4\right)$	Write the midpoint of PQ as a set of coordinates.
Midpoint PR = $\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$	Write down the formula to determine the midpoint of a line segment PR.
Midpoint PR = $\left(\frac{1 + (-2)}{2}; \frac{-2 + 5}{2}\right)$	Substitute the values P(–2; 5) and R(1; –2) into the midpoint formula.
Midpoint PR = $\left(-\frac{1}{2}; \frac{3}{2}\right)$	Simplify and write the midpoint of PR as a set of coordinates.

(4)

SOLUTION 2.5.3

Steps	Explanation
$m_{MN} = \frac{y_2 - y_1}{x_2 - x_1}$	Write down the formula for the gradient of a line.
$m_{MN} = \frac{5}{2}$	Simplify.
$m_{PQ} = \frac{3 + 2}{3 - 1}$	Substitute the values into the gradient formula.
$m_{PQ} = \frac{5}{2}$	Simplify.

(4)

SOLUTION 2.5.3

Steps	Explanation
$A = \frac{1}{2} \times b \times h$	Write down the formula for the area of a right-angled triangle.
$A = \frac{1}{2} \times PQ \times QR$	Use PQ and QR as the perpendicular sides.
$A = \frac{1}{2} \times \sqrt{29} \times \sqrt{29}$	Substitute the lengths of PQ and QR.
$A = \frac{29}{2}$ units	Simplify.

(2)

QUESTION 3: Translations and reflections

SOLUTION 3.1

Steps	Explanation
3.1.1 (0; 0)	A is translated 2 units down and 1 unit to the left.
3.1.2 (–2; 5)	B is reflected about the *y*-axis.
3.1.3 (5; –3)	Ĉ if is reflected about the *x*-axis.

(6)

SOLUTION 3.2

Steps	Explanation
3.2.1 C'(–4; –4)	Point C moves 3 units to the left and 2 units down.
3.2.2 B'(5; –3)	Point B is reflected about the *x*-axis.
3.2.3 A'(4; –4)	Point A is reflected about the line $y = x$.

(6)

SOLUTION 3.3 3.3.1

Steps	Explanation
$A^1 = (4; 0)$	Point A translated two units right and three units down.
$B^1 = (8; 1)$	Point B translated two units right and three units down.
$C^1 = (6; –2)$	Point C translated two units right and three units down.

(3)

SOLUTION 3.3.2

Steps	Explanation
$A^1 = (–3; –2)$	Reflected in the line $y = x$

(1)

SOLUTION 3.4 3.4.1

Steps	Explanation
$P^1 = (3; -2)$	Translate point P by 1 unit right and 4 units down.
$Q^1 = (6; -1)$	Translate point Q by 1 unit right and 4 units down.
$R^1 = (5; -3)$	Translate point R by 1 unit right and 4 units down.

(6)

SOLUTION 3.4.2

Steps	Explanation
$P(2; 2) \rightarrow P^1(-2; -2)$	Point P if it is reflected about $y = -x$.

(2)

SOLUTION 3.4.3

Steps	Explanation
$Q(5; 3) \rightarrow Q^1(3; 5)$	Point Q if it is reflected about $y = x$.

(2)

SOLUTION 3.5

Steps	Explanation
3.5.1 Translated by two units to the right and five units upwards	Transformation of $A(7; -5) \rightarrow A'(9; 0)$
3.5.2 Reflection at the y-axis **OR** Move 8 units to the right.	Transformation of $B(-4; 6) \rightarrow B'(4; 6)$
3.5.3 Reflection at the $y = x$ **OR** Move 1 unit to the right then one unit downwards. **OR** Move 1 unit downwards then one unit to the right.	Transformation of $C(-3; -2) \rightarrow C'(-2; -3)$
3.5.4 Reflection at the x-axis **OR** Move 2 units downwards.	Transformation of $D(8; 1) \rightarrow D'(8; -1)$

(5)

Part B: Trigonometry

QUESTION 1: Use trig functions to solve problems (Theorem of Pythagoras)

SOLUTION 1.1 1.1.1

Steps	Explanation
$r^2 = x^2 + y^2$	Use the Theorem of Pythagoras to determine the value of the hypotenuse.
$r^2 = (1)^2 + (2)^2$	Substitute the length of the opposite side and the adjacent side.
$r^2 = 1 + 4$	Simplify the brackets.
$r^2 = 5$	Simplify.
$r = \sqrt{5}$	Take the square root of 5 to get *r* isolated. Note that *r* cannot be negative.
$\sin\theta - \cot\theta$	Identify the trigonometric expression and the values of the opposite, adjacent and the hypotenuse.
$= \frac{1}{\sqrt{5}} - \frac{2}{1}$	Use the trigonometric ratio to substitute the value: $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$ $\cot\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$= \frac{1 - 2\sqrt{5}}{\sqrt{5}}$	Simplify the fractions to one term by getting the LCM.
$= \frac{1 - 2\sqrt{5}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$	Rationalise the fraction to get rid of the surd in the denominator.
$= \frac{\sqrt{5} - 10}{5}$	Simplify.

(3)

SOLUTION 1.1.2

Steps	Explanation
$3\cos^2\theta + \text{cosec}\,\theta$	Identify the trigonometric expression.
$= 3\left(\frac{2}{\sqrt{5}}\right)^2 + \frac{\sqrt{5}}{1}$	Substitute the trigonometric ratios.
$= \frac{3}{1}\left(\frac{4}{5}\right) + \frac{\sqrt{5}}{1}$	Simplify inside the bracket.
$= \frac{12}{5} + \frac{\sqrt{5}}{1}$	Simplify by removing the bracket.
$= \frac{12 + \sqrt{5}}{5}$	Get the LCM of the fractions and simplify it.

(3)

SOLUTION 1.2 1.2.1

Steps	Explanation
$\cos^2 30° + \sqrt{\tan 45°} + \sin(60° + 30°)$	Identify the special angles in the trigonometric expression.
$= \left(\frac{\sqrt{3}}{2}\right)^2 + \sqrt{1} + \sin(90°)$	Substitute the trigonometric ratios using special angles.
$= \frac{3}{4} + 1 + 1$	Simplify.
$= 2\frac{3}{4}$	Simplify without using a calculator.

(3)

SOLUTION 1.2.2

Steps	Explanation
$\sin 45° \div \cos 45°$	Identify the special angles in the trigonometric expression.
$\frac{\sin 45°}{\cos 45°} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{2}}}$	Substitute the trigonometric ratios using special angles.
$= 1$	Simplify.

(3)

SOLUTION 1.3

Steps	Explanation
$\sin 30° = \frac{h}{10}$	Use the trigonometric ratio for $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$
$h = 10 \sin 30°$	Manipulate the trigonometric ratio to get h the subject.
$h = 5$ m	Use your calculator to get the value of h.

(3)

SOLUTION 1.4 1.4.1

Steps	Explanation
$\sin 70° = \frac{40}{BC}$	Use the trigonometric ratio $\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$
$BC = \frac{40}{\sin 70°}$	Manipulate the trigonometric ratio to get BC the subject.
BC = 45,567	Use your calculator to get the value of BC.

(3)

SOLUTION 1.4.2

Steps	Explanation
$1 - \sin^2 70°$	Identify the trigonometric expression with opposite side = 40 units.
$= 1 - \left(\frac{40}{42{,}567}\right)^2$	Substitute the values of the opposite side and the hypotenuse into the ratio: $\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$
= 0,117	Use your calculator to simplify it.

(3)

SOLUTION 1.4.3

Steps	Explanation
$AC = \sqrt{(42{,}567)^2 - (40)^2}$	Use the Theorem of Pythagoras to determine the value of AC.
AC = 14,558	Use your calculator to get the value of AC.
$\tan 70° = \frac{40}{14{,}558} = 2{,}748$	Substitute the length of AC into the trigonometric ratio and simplify.

(3)

SOLUTION 1.5 1.5.1

Steps	Explanation
$\tan \theta = \frac{4}{3}$	Use the trigonometric ratio for $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$
$\theta = \tan^{-1} \frac{4}{3}$	Use arc tan to get the angle θ.
θ = 53,130°	Use your calculator to get the value of θ.

(3)

SOLUTION 1.5.2

Steps	Explanation
$DB^2 + 4^2 = 7^2$	Use the Theorem of Pythagoras to determine the value of side DB.
$DB^2 = 7^2 - 4^2$	Make DB^2 the subject of the equation.
$DB = \sqrt{(7^2 - 4^2}$	Isolate DB by taking a square root.
$DB = \sqrt{33}$	Simplify.

(2)

SOLUTION 1.5.3

Steps	Explanation
$\cos \alpha = \frac{4}{7}$	The ratio for $\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$\alpha = \cos^{-1} \frac{4}{7}$	Use arc cos to get the angle α.
$\alpha = 55{,}150°$	Insert a degree sign as α is an angle.

(3)

SOLUTION 1.6 1.6.1

Steps	Explanation
Hypotenuse	The longest side of the right-angled triangle

(1)

SOLUTION 1.6.2

Steps	Explanation
$\cos T = \frac{10}{15} = \frac{2}{5}$	The ratio for $\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$

(2)

SOLUTION 1.6.3

Steps	Explanation
$\hat{T} = \cos^{-1} \frac{2}{3}$	Use arc cos to get the angle T.
$\hat{T} = 48{,}190°$	Insert a degree sign as T is an angle.

(2)

SOLUTION 1.6.4

Steps	Explanation
$RT^2 = RS^2 + ST^2$	Use the Theorem of Pythagoras.
$15^2 = RS^2 + 10^2$	Substitute the dimensions of the hypotenuse and the side.
$RS = \sqrt{15^2 - 10^2}$	Rearrange the equation
$RS = 5\sqrt{5}$ or 11,180 units	Use a calculator and simplify.
OR	
$\sin 48{,}190° = \frac{RS}{15}$	Use the trigonometric ratio for $\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$
$RS = 15 \sin 48{,}190°$	Manipulate the trigonometric ratio to get RS the subject.
RS = 11,180 units	Use your calculator to get the value of RSC.

(3)

SOLUTION 1.7 1.7.1

Steps	Explanation
$r^2 = (8)^2 + (15)^2$	Use the Theorem of Pythagoras.
$r^2 = 64 + 225$	Simply by squaring the values.
$r^2 = 289$	Simplify.
$r = 17$	Isolate *r* by taking the square root.

(2)

SOLUTION 1 7.2

Steps	Explanation
$\sin \beta + \cos \beta = \frac{8}{17} + \frac{15}{17}$	Use the trigonometric ratio for $\sin \beta = \frac{\text{opposite}}{\text{hypotenuse}}$ and $\cos \beta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$\sin \beta + \cos \beta = \frac{23}{17}$	Simplify.

(2)

SOLUTION 1 7.3

Steps	Explanation
$\tan \beta \times \cos \beta = \frac{15}{8} \times \frac{8}{17}$	Use the trigonometric ratio for $\tan \beta = \frac{\text{opposite}}{\text{adjacent}}$ and $\cos \beta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$\tan \beta \times \cos \beta = \frac{15}{17}$	Simplify.

(2)

SOLUTION 1 8 1.8.1

Steps	Explanation
cos (75° – 15°)	Identify the trigonometric expression with brackets.
= cos 60°	Use special angles to simplify it.
$= \frac{1}{2}$	Simplify.

(2)

SOLUTION 1.8.2

Steps	Explanation
sin (75° + 15°) + $\cos^2$ 0° – tan 45°	Identify the trigonometric expression with brackets.
= sin 90° + cos 0° – tan 45°	First simplify by removing the brackets
= 1 + 1 – 1	Use special angles to simplify it.
= 2 – 1	Simplify again.
= 1	You can check your answer using a calculator.

(2)

QUESTION 2: Trig ratios in quadrants

SOLUTION 2.1 2.1.1

Steps	Explanation
$\tan\theta = \sin 90°$	Use special angles to simplify sin 90°.
$\tan\theta = 1$	$\sin 90° = 1$
$\theta = \tan^{-1}(1)$	Use arc tan to get the angle θ.
$\theta = 45°$	Use special angles tan 45° to simplify it.

(3)

SOLUTION 2.1.2

Steps	Explanation
$\frac{2}{\text{cosec}\,\theta} - 1 = 0$	Identify it as a trigonometric equation and you need to find the angle.
$2\sin\theta = 1$	Rewrite $\frac{2}{\text{cosec}\,\theta}$ as $2\sin\theta$.
$\sin\theta = \frac{1}{2}$	Isolate the trigonometric ratio.
$\theta = \sin^{-1}\left(\frac{1}{2}\right)$	Use the arc function to isolate the angle.
$\theta = 30°$	Use a calculator and insert the degree sign.

(3)

SOLUTION 2.2 2.2.1

Steps	Explanation
$5 = \sqrt{a - 0)^2 + (4 - 0)^2}$	Use the distance formula between two coordinates.
$25 = a^2 + 4^2$	Simplify under the root sign and square the left-hand side to get rid of the root sign.
$a^2 = 25 - 16$	Isolate a^2.
$a = 3$	Take the square root to get the value of a.

(3)

SOLUTION 2.2.2

Steps	Explanation
Coordinate of Q = (3; 0)	Look at the x-intercept.

(2)

SOLUTION 2.3 2.3.1

Steps	Explanation
$P = \sqrt{5^2 + 7^2}$	Use the Theorem of Pythagoras.
$P = \sqrt{74}$	Simplify by squaring the values.
P = 8,602	Use your calculator to get the value of P.

(3)

SOLUTION 2.3.2

Steps	Explanation
$\cos \theta = \frac{5}{8{,}602}$	Use the trigonometric ratio for $\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$\sin \theta = \frac{75}{8{,}602}$	Use the trigonometric ratio for $\sin \beta = \frac{\text{opposite}}{\text{hypotenuse}}$
$\frac{\cos \theta}{\sin \theta} = \frac{5}{8{,}602} \times \frac{8{,}602}{7}$	Substitute the values into the ratios.
$\frac{\cos \theta}{\sin \theta} = \frac{5}{7} = 0{,}714$	Simplify.

(4)

SOLUTION 2.3.3

Steps	Explanation
$\tan \theta = \frac{7}{5}$	Substitute the values of the opposite side and the adjacent into the ratio: $\tan \beta = \frac{\text{opposite}}{\text{adjacent}}$
$\theta = \tan^{-1}\left(\frac{7}{5}\right)$	Use the arc function to determine the angle.
$\theta = 54{,}462°$	Use your calculator to determine the angle. Insert the degree sign with the angle.

(3)

SOLUTION 2.4 2.4.1

Steps	Explanation
$PO^2 = 12^2 + (-5)^2$	Use the Theorem of Pythagoras.
$PO = \sqrt{(12^2 + (-5)^2}$	Get PQ alone by square rooting the other side.
PO = 13	Simply by squaring the values.

(3)

SOLUTION 2.4.2

Steps	Explanation
$\frac{12}{13} + \left(\frac{-5}{13}\right)$	Substitute the values into the trigonometric ratios.
$= \frac{7}{13}$	Simplify.

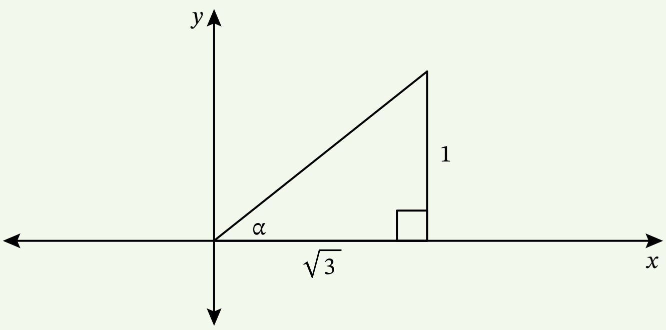
(3)

SOLUTION 2.4.3

Steps	Explanation
$\theta = 180° - \tan^{-1}\frac{12}{5}$	Use the tan ratio.
$\theta = 180° - 67{,}380°$	Simplify.
$\theta = 112{,}62°$	Use your calculator to get the value of θ.

(3)

SOLUTION 2.5 2.5.1

Steps	Explanation
	
$\tan \alpha = \frac{1}{\sqrt{3}}$	Use the trigonometric ratio for $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$
$r^2 = x^2 + y^2$	Use the Theorem of Pythagoras.
$r^2 = (\sqrt{3})^2 + (1)^2$	Substitute the values into the Theorem of Pythagoras.
$r^2 = 3 + 1$	Simply by squaring the values.
$r^2 = 4$	Simplify.
$r = 2$	Simplify by square rooting.
$\cos \alpha = \frac{\sqrt{3}}{2}$	Use the trigonometric ratio for $\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$

(3)

SOLUTION 2.5.2

Steps	Explanation
$1 + 3^{\frac{1}{3}}$	Substitute the values.
$= 1 + 1$	Simplify.
$= 2$	Simplify.

(2)

SOLUTION 2.6 2.6.1

Steps	Explanation
$\cos \theta = \frac{24}{25}$	Use the trigonometric ratio for $\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$
$(25)^2 = (24)^2 + y^2$	Use the Theorem of Pythagoras.
$y^2 + 576 = 625$	Simply by squaring the values.
$y^2 = 49$	Simplify again and get the *y*-term alone.
$y = 7$	Simplify again and get the *y*-term alone.
$\sin \theta = \frac{7}{25}$	Use the trigonometric ratio for $\sin \theta = \frac{\text{adjacent}}{\text{opposite}}$

(3)

SOLUTION 2.6.2

Steps	Explanation
$5 \cos \theta - 12 \tan \theta$	Identify the trigonometric expression.
$= 5\left(\frac{24}{25}\right) - 12\left(\frac{7}{24}\right)$	Substitute the values.
$= \frac{24}{5} - \frac{7}{2}$	Simplify.
$= \frac{48 - 35}{10}$	Get the LCM and add the fractions.
$= \frac{13}{10}$	Simplify.

(3)

SOLUTION 2.7 2.7.1

Steps	Explanation
$\alpha - 20° = 30°$	Create the equation.
$\alpha = 30° + 20°$	Kick over.
$\alpha = 50°$	Solve the equation.
OR	
$\theta - 20° = 330°$	Create the equation.
$\alpha = 350°$	Solve the equation.

(2)

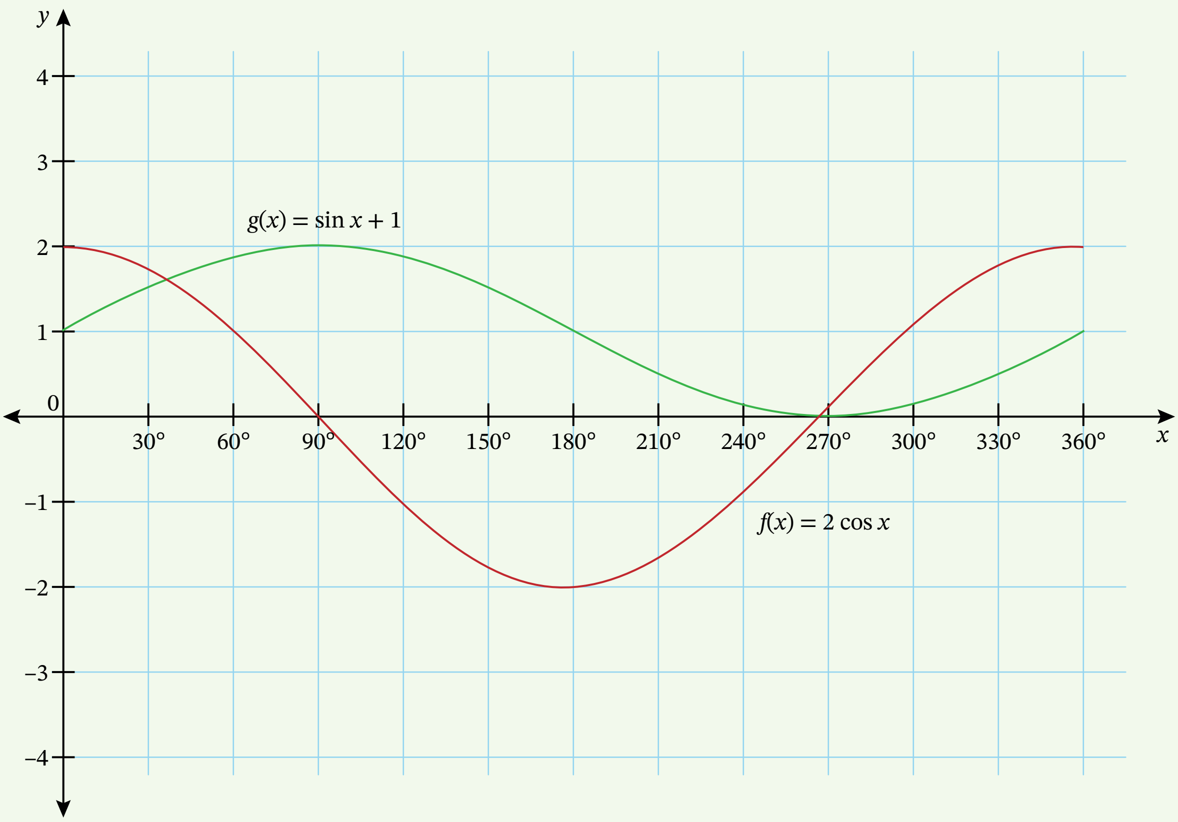
SOLUTION 2.7.2

Steps	Explanation
$\sin \alpha = 0{,}468$	Create the trigonometric equation.
$\alpha = \sin^{-1} 0{,}468$	Isolate α.
$\alpha = 27{,}9°$	Insert the degree sign as you calculated the angle.
OR	
$\alpha = 180° - \sin^{-1} 0{,}468$	Create the equation.
$\alpha = 152{,}1°$	Solve the equation and insert the degree sign as you calculated the angle.

(2)

QUESTION 3: Trig graphs

SOLUTION 3.1 3.1.1

Steps	Explanation
	

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
f(*x*)	2	1,73	1	0	–1	–1,73	–2	–1,73	–1	0	1	1,73	2
g(*x*)	1	1,5	1,86	2	1,86	1,5	1	0,5	0,13	0	0,13	0,5	1

2 for table + 4(8 × ½) for graph) (6)

SOLUTION 3.1.2 to 3.1.4

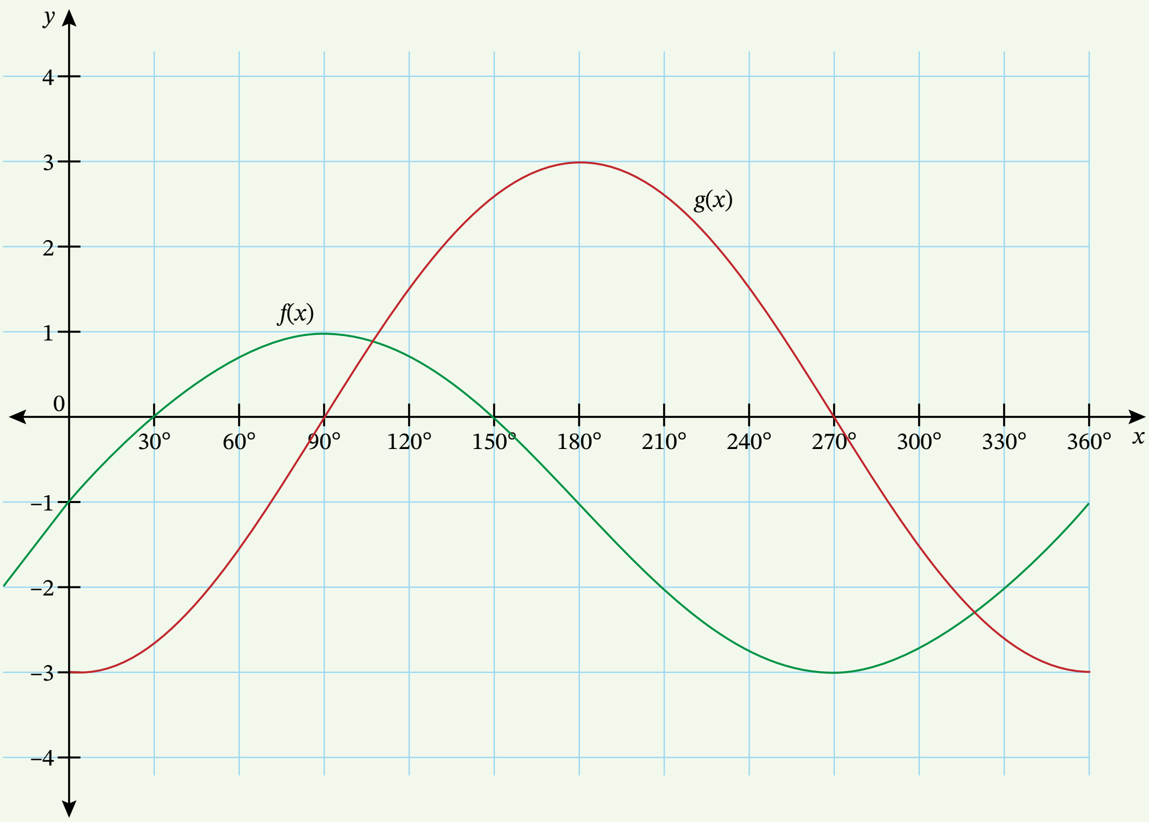
Steps	Explanation
3.1.2 2	Look at the amplitude.
3.1.3 360°	The cycle is 360°.
3.1.4 Range of $g(x)$: $0 \leq y \leq 2$ or $y \in [0; 2]$ Domain of $g(x)$: $0° \leq x \leq 360°$ or $y \in [0°; 360°]$	Range is the *y*-values. Domain is the *x*-values.

(4)

SOLUTION 3.2

Steps	

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$f(x)$	–1	0	–0,732	1	0,732	0	–1	–2	–2,732	–3	–2,732	–2	–1
$g(x)$	–3	–2,59	–1,5	0	1,5	2,598	3	2,598	1,5	0	–1,5	–2,598	–3



(6)

SOLUTION 3.2.2 to 3.2.5

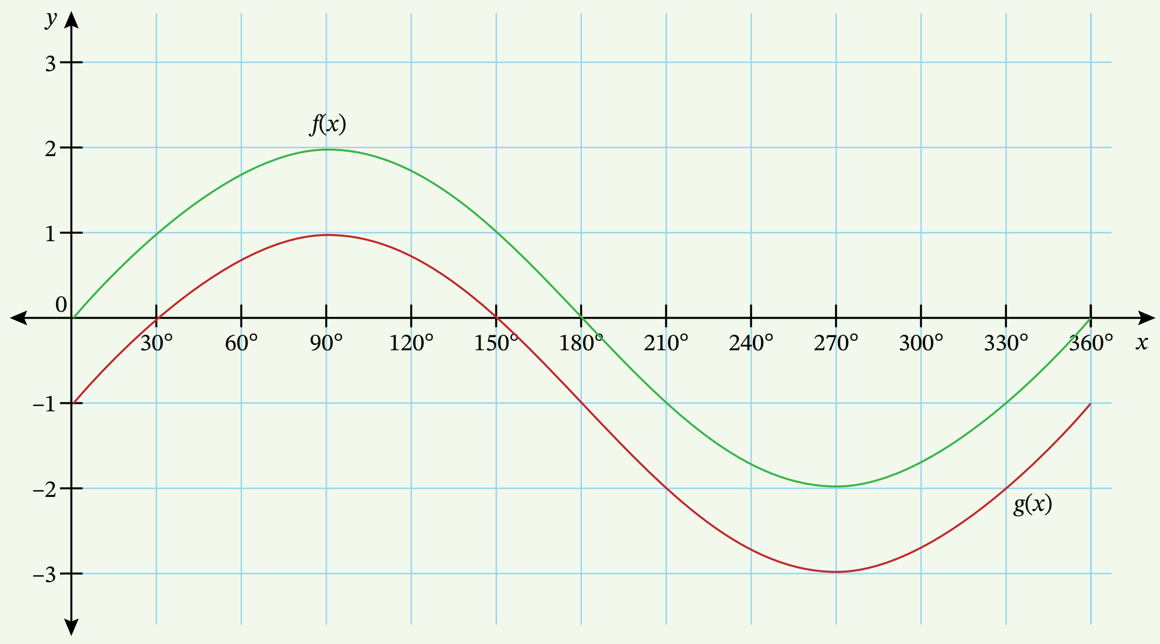
Steps	Explanation
3.2.2 Domain of $g(x) = 0° \leq x \leq 360°$ **OR** [0°; 360]	The domain of the trigonometric function is the set of all possible input values (x).
3.2.3 $-3 \leq y \leq 3$	Look at the y-axis to identify where the graph reaches its minimum and maximum values.
3.2.4 2	
3.2.5 360°	

(6)

SOLUTION 3.3 3.3.1

Steps	Explanation

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$f(x)$	0	1	1,732	2	1,732	1	0	–1	–1,732	–2	–1,732	–1	0
$g(x)$	–1	0	0,732	1	0,732	0	–1	–2	–2,732	–3	–2,732	–2	–1



(6)

SOLUTION 3.3.2 to 3.3.6

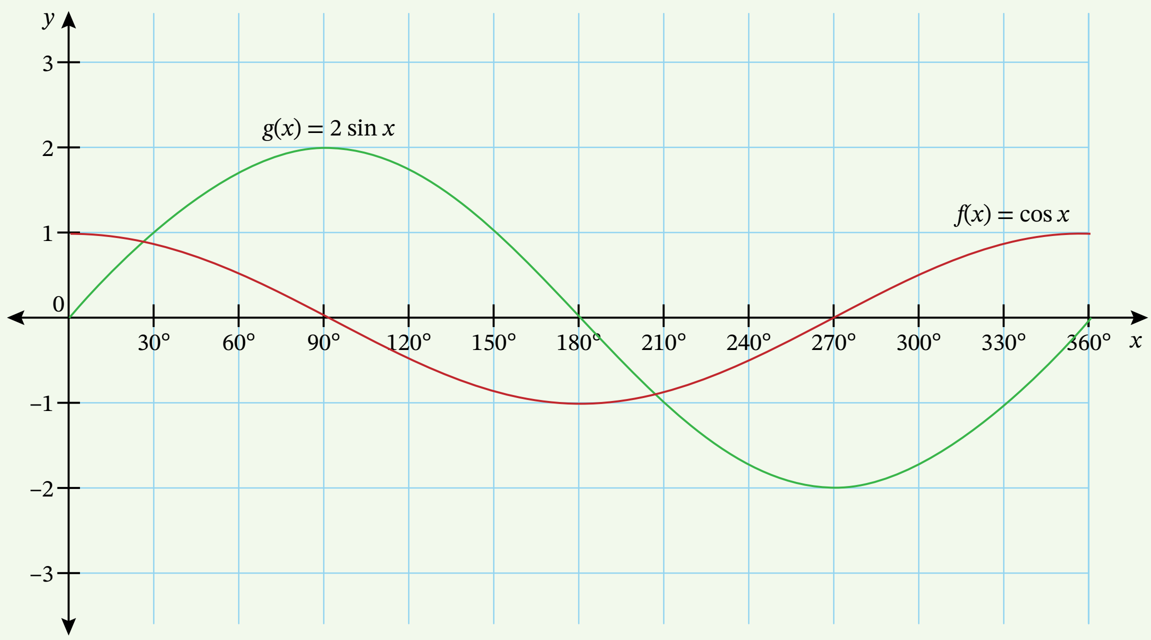
Steps	Explanation
3.3.2 $a = 2$	Amplitude of $f(x)$
3.3.3 $a = 2$	Amplitude of $g(x)$
3.3.4 Range of $g(x) = -3 \leq y \leq 1$ and domain is $0° \leq x \leq 360°$	Look at the y-axis to identify where the graph reaches its minimum and maximum values.
3.3.5 360°	Complete cycle of graph
3.3.6 No point of intersection	The two graphs do not cut each other.

(9)

SOLUTION 3.4 3.4.1

Steps	Explanation

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$f(x) = \cos x$	1	0,86	0,5	0	–0,5	–0,86	–1	–0,86	–0,5	0	0,5	0,86	1
$g(x) = 2 \sin x$	0	1	1,73	2	1,73	1	0	–1	–1,73	–2	–1,73	–1	0



(6)

SOLUTION 3.4.2 and 3.4.3

Steps	Explanation
3.4.2 Period of $f(x) = 360°$	Period is how many degrees to complete a cycle.
3.4.3 Range of $g(x)$: $-2 \leq y \leq 2; y \in R$	Range gets impacted by the *y*-values of the graph.

(2)

SOLUTION 3.5 3.5.1

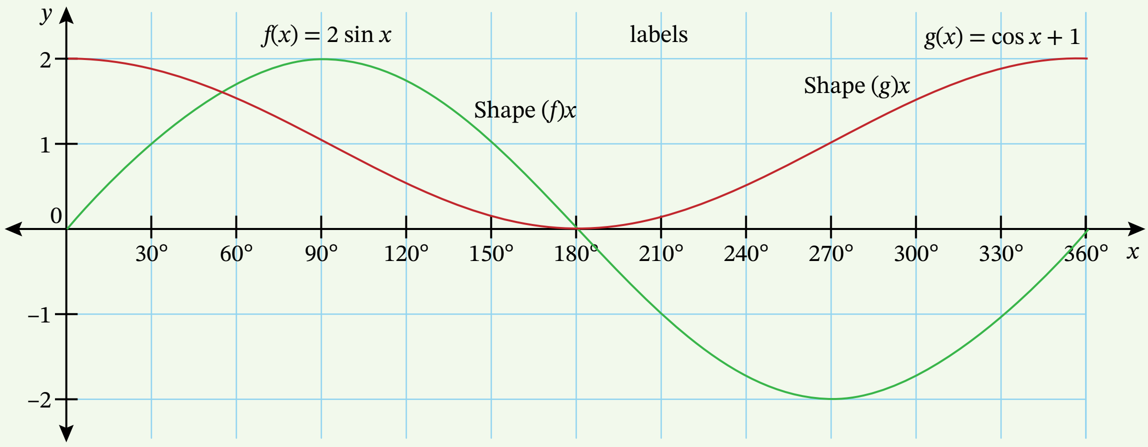
Steps	Explanation
$y \in [-2; 2]$	Range gets impacted by the *y*-values of the graph.

(2)

SOLUTION 3.5.2

Steps

x	0°	45°	90°	135°	180°	225°	270°	315°	360°
$f(x) = 2 \sin x$	0	1,4	2	1,4	0	–1,4	–2	–1,4	0
$g(x) = \cos x + 1$	2	1,7	1	0,3	0	0,3	1	1,7	2

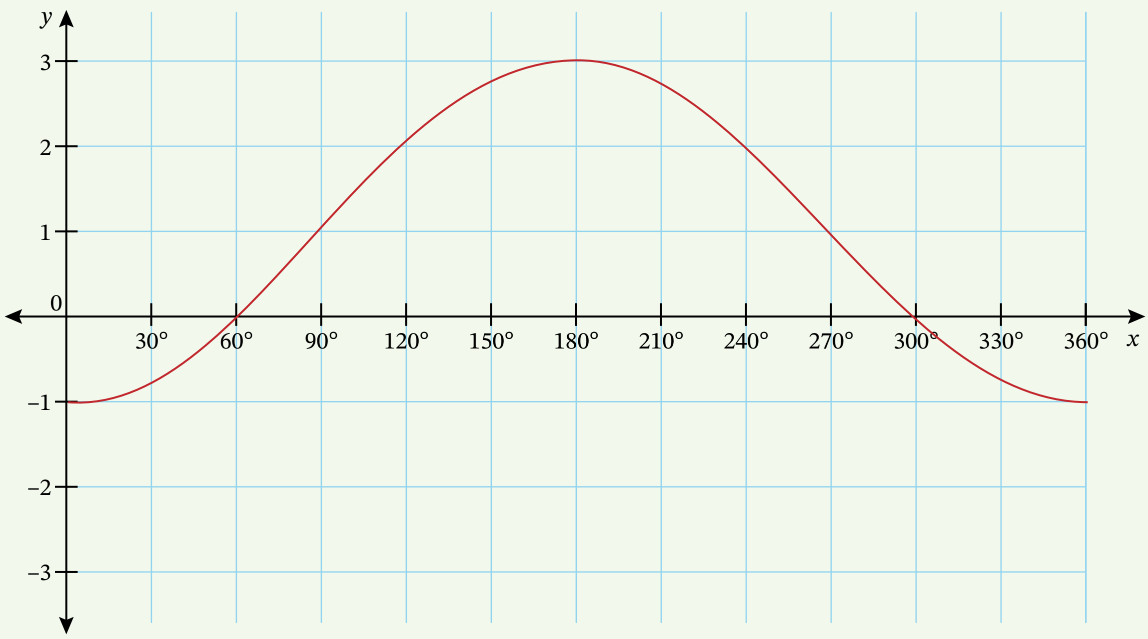


(8)

SOLUTION 3.6

Steps

x	0°	90°	180°	270°	360°
$f(x) = -2 \cos x + 1$	–1	1	3	1	–1



Explanation

The basic cos-graph is reflected in the x-axis because of the minus and a vertical upward of 1.

(3)

QUESTION 4: Problems in two dimensions (angles of elevation and depression)

SOLUTION 4.1

Steps	Explanation
$BD = \frac{2\,000}{\tan 30°}$	Find the ratio for BD.
BD = 3 464,102 m	Simply the fraction.
$BC = \frac{2\,000}{\tan 60°}$	Find the ratio for B.
BC = 1 154,700	Simply the fraction.
Distance between the boats CD = 3 464,102 – 1 154,700 = 2 309,402 m	Find the distance between the boats by subtracting the lengths.

(4)

SOLUTION 4.2

Steps	Explanation
$\tan 35° = \frac{\text{height}}{45 \text{ cm}}$	Identify the trigonometric ratio.
Height = 45 × tan 35°	Manipulate the equation.
= 31,51	Use a calculator and simplify.
x = 31,51 m + 1,5 m	Add the lengths.
x = 33,01 m	Check if the length is reasonable.

(5)

SOLUTION 4.3 4.3.1

Steps	Explanation
$C\hat{A}B = 90° - 30° = 60$	Find the third angle in the triangle.
$\tan 60° = \frac{BC}{20}$	$\tan \beta = \frac{\text{opposite}}{\text{adjacent}}$
BC = 20 tan 60°	Manipulate the equation.
BC = 34,641 cm	Use a calculator and simplify.

(3)

SOLUTION 4.3.2

Steps	Explanation
$AB^2 = (20)^2 + (20\sqrt{3})^2$	Use the Theorem of Pythagoras.
$AB = \sqrt{(20)^2 + (20\sqrt{3})^2)}$	Substitute the values into the Theorem of Pythagoras.
AB = 40 cm	Use a calculator and simplify.

(2)

SOLUTION 4.4 4.4.1

Steps	Explanation
$\sin 37° = \frac{6{,}4}{AB}$	Use the trigonometric ratio for $\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$
$AB = \frac{6{,}4}{\sin 37°}$	Make AB the subject of the equation.
AB = 10,634 km	Use a calculator and simplify.

(3)

SOLUTION 4.4.2

Steps	Explanation
$\tan 37° = \frac{6{,}4}{AC}$	Identify the trigonometric ratio.
$AC = \frac{6{,}4}{\tan 37°}$	Manipulate the equation.
AC = 8,493 km	Use a calculator and simplify.

(3)

SOLUTION 4.5 4.5.1

Steps	Explanation
$A\hat{D}C = 45° + 10° = 55°$	Find the angle.

(1)

SOLUTION 4.5.2

Steps	Explanation
$\tan 45° = \frac{12}{DC}$	Use the trigonometric ratio for $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$
$DC = \frac{12}{\tan 45°}$	Manipulate the equation.
DC = 12 m Isosceles triangle	Use a calculator to find DC.

(3)

SOLUTION 4.5.3

Steps	Explanation
$\tan 55° = \frac{AC}{DC}$	Use the trigonometric ratio for $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$
$\tan 55° = \frac{AC}{12}$	Substitute the values into the equation.
$\tan 55° \times 12 = DC$	Manipulate the equation.
DC = 17,138 m	Use a calculator to find DC.

(2)

SOLUTION 4.5.4

Steps	Explanation
AB = 17,138 m − 12 m	Find the difference in length.
AB = 5,138 m	Check if the length is reasonable.

(2)

Question papers Maths L2

Introduction to Paper 1 and Paper 2

Proposed mark distribution between Paper 1 and Paper 2 for external examination papers

Paper 1	
Topics	**Marks**
1. Numbers	30
2. Functions and Algebra	
2.1 Functions	25
2.2 Algebra	25
5. Financial Mathematics	20
Total	**100**

Paper 2	
Topics	**Marks**
3. Space, Shape and Measurement	
3.1 Geometry	30
3.2 Trigonometry	30
4. Data Handling	40
Total	**100**

Formula sheets

Paper 1

Paper 2

Chapter 4: **Data handling** (Paper 2)

QUESTION 1: Central tendencies and data dispersion

SOLUTION 1.1 1.1.1

Steps	Explanation
The average of a data set is calculated by adding all the numbers together and dividing by the total count of numbers.	The mean, often referred to as the average, is calculated by adding all values in a dataset and dividing by the number of values.

(2)

SOLUTION 1.1.2

Steps	Explanation
The middle value of ordered data	The data must be in ascending order.

(2)

SOLUTION 1.2 1.2.1

Steps	Explanation
$Q_{1position} = \frac{1}{4}(n + 1) = \frac{1}{4}(9 + 1) = 2,5$	Find the position of the lower quartile.
$Q_1 = P_2 + 0,5(P_3 - P_2)$	Find the lower quartile.
$Q_1 = 24 + 0,5(27 - 24)$	Substitute the values.
$Q_1 = 25,5$	Simplify.

(2)

SOLUTION 1.2.2

Steps	Explanation
$Q_{3position} = \frac{3}{4}(n + 1) = \frac{3}{4}(9 + 1) = 7,5$	Find the position of the upper quartile.
$Q_3 = P_7 + 0,5(P_8 - P_7)$	Find the upper quartile.
$Q_3 = 35 + 0,5(48 - 35)$	Substitute the values.
$Q_3 = 41,5$	Simplify.

(2)

SOLUTION 1.2.3

Steps	Explanation
IQR = $Q_3 - Q_1$	The Interquartile Range (IQR) is the difference between the third quartile (Q_3) and the first quartile (Q_1).
IQR = 41,5 – 25,5	Substitute the values of Q_3 and Q_1 into the formula.
IQR = 16	Simplify.

(2)

SOLUTION 1.2.4

Steps	Explanation
Semi IQR = $\frac{IQR}{2}$	Semi IQR is half of the Interquartile Range (IQR).
Semi IQR = $\frac{16}{2}$	Substitute the value of IQR into the formula.
Semi IQR = 8	Simplify.

(1)

SOLUTION 1.2.5

Steps	Explanation
$P_{75\text{th position}} = \frac{75}{100}(n + 1) = \frac{3}{4}(9 + 1) = 7{,}5$	Find the position of the percentile.
$P_{75\text{th}} = P_7 + 0{,}5(P_8 - P_7)$	Find the percentile.
= 35 + 0,5(48 – 35)	Substitute the values.
= 41,5	Simplify.

(3)

SOLUTION 1.3

Steps	Explanation
1.3.1 The number of participants or observations included in a study	Sample size
1.3.2 The most common number in a data set	Modal value

(4)

SOLUTION 1.4

Steps	Explanation
65, 66, 66, 67, 71, 72, 74, 75, 77, 80, 81, 88	Arrange the data in ascending order.

SOLUTION 1.4.1

Steps	Explanation
$Q_1 = 79{,}25$	Q_1 is the median of the lower half.

(2)

SOLUTION 1.4.2

Steps	Explanation
$Q_3 = 79{,}25$	Q_3 is the median of the upper half.

(2)

SOLUTION 1.4.3

Steps	Explanation
$IQR = Q_3 - Q_1$	The Interquartile Range (IQR) is the difference between the third quartile (Q_3) and the first quartile (Q_1).
$IQR = 79{,}25 - 66{,}25$	Substitute the values of Q_3 and Q_1 into the formula.
$IQR = 13$	Simplify.

(2)

SOLUTION 1.4.4

Steps	Explanation
Range = 88 – 65 = 23	Range refers to the difference between the highest and lowest values in a dataset.

(1)

SOLUTION 1.4.5

Steps	Explanation
68th percentile $= \frac{68}{100}(12 + 1)$ = 8,84 position	Find the position of the percentile.
$= 75 + 0{,}84(77 - 75)$	Find the position of the percentile.
$= 76{,}68$	Simplify.

(3)

SOLUTION 1.5

Steps	Explanation
1.5.1 Discrete data is the information gathered from a survey or questionnaire	Discrete data is data that can take only specific, fixed values. These values are distinct and cannot be divided into smaller parts. In other words, discrete data includes a limited set of whole numbers and integers and cannot be expressed in fractions or decimals. Each value stands on its own and can only be counted, not measured.
1.5.2 The mean of data is the numerical value found by adding together all the separate values of the data and dividing the answer by the numerical values.	The mean is the average of the data set.

(4)

SOLUTION 1.6

Steps	Explanation
12, 14, 17, 22, 25, 29, 30, 30, 32, 33, 35, 48	Arrange the data in ascending order.

SOLUTION 1.6.1

Steps	Explanation
Range = maximum – minimum	Range refers to the difference between the highest and lowest values in a dataset.
Range = 48 – 12	Substitute the values.
Range = 36	Simplify.

(1)

SOLUTION 1.6.2

Steps	Explanation
$Q_1 = \frac{1}{4}(12 + 1)$	
= 3,25 position	
$Q_1 = 17 + 0{,}25(22 - 17) = 18$	

(2)

SOLUTION 1.6.3

Steps	Explanation
$Q_{3position} = \frac{3}{4}(12 + 1) = 9{,}75$ position	Find the position of the upper quartile.
$Q_3 = 32 + 0{,}75(33 - 32)$	Substitute the values.
$Q_3 = 32{,}5$	Simplify.

(2)

SOLUTION 1.6.4

Steps	Explanation
$IQR = Q_3 - Q_1$	
$IQR = 32{,}75 - 18$	
$IQR = 14{,}75$	

(2)

SOLUTION 1.6.5

Steps	Explanation
Semi IQR = $\frac{IQR}{2}$	Semi IQR is half of the Interquartile Range (IQR).
Semi IQR = $\frac{14{,}75}{2}$	Substitute the value of IQR into the formula.
Semi IQR = 7,385	Simplify.

(1)

SOLUTION 1.6.6

Steps	Explanation
67th percentile = $\frac{67}{100}(12 + 1)$	Find the position of the percentile.
= 8,71 position	Find the position of the percentile.
67th percentile = $30 + 0{,}71(32 - 30)$	Substitute the values.
67th percentile = 31,42	Simplify.

(3)

SOLUTION 1.7

Steps	Explanation
1.7.1 Information obtained from a sample (survey or questionnaire, for example) before any statistical process has been applied	Raw data
1.7.2 The number of times a value occurs within a data set	Frequency of data

(4)

SOLUTION 1.8

Steps	Explanation
30, 35, 38, 39, 44, 47, 48, 50, 56, 59, 61	Rearrange the data in ascending order.

SOLUTION 1.8.1

Steps	Explanation
Range = maximum – minimum	Range refers to the difference between the highest and lowest values in a dataset.
Range = 61 – 30	Substitute the values.
Range = 31	Simplify.

(1)

SOLUTION 1.8.2

Steps	Explanation
$Q_{1position} = \frac{1}{4}(11 + 1) = 3$	The lower quartile position.
$Q_1 = 38$	Simplify.

(2)

SOLUTION 1.8.3

Steps	Explanation
$Q_{3position} = \frac{3}{4}(11 + 1) = 9$	Find the position of the upper quartile.
$Q_3 = 56$	Simplify.

(2)

SOLUTION 1.8.4

Steps	Explanation
IQR = $Q_3 - Q_1$	The Interquartile Range (IQR) refers to the value you get when you subtract the first quartile (Q_1) from the third quartile (Q_3).
IQR = 56 – 38	Substitute the values.
IQR = 18	

(2)

SOLUTION 1.8.5

Steps	Explanation
Semi-interquartile = $\frac{56-38}{2}$	Semi-IQR = 32 = 16
= 9	Simplify.

(1)

SOLUTION 1.8.6

Steps	Explanation
$P_{37position} = \frac{37}{100}(11 + 1) = 4{,}44$	Find the position of the percentile.
$P_{37} = 39 + 0{,}44(44 - 39)$	Substitute the values.
$P_{37} = 41{,}2$	Simplify.

(3)

SOLUTION 1.9

Steps	Explanation
1.9.1 The difference between the highest and lowest data values in a data set.	Range
1.9.2 The original data collected before any processing has been done.	Raw data

(4)

SOLUTION 1.10 1.10.1

Steps	Explanation
<table><tr><th>Stem</th><th>Leaf</th></tr><tr><td>1</td><td>8 9</td></tr><tr><td>2</td><td>0 3 5 5 5 9</td></tr><tr><td>3</td><td>2 2 3 4 4 5 6 7</td></tr><tr><td>4</td><td>0 2</td></tr><tr><td>5</td><td>4 5</td></tr></table>	A stem-and-leaf diagram is a method of organising numerical data by splitting each number into a stem (the leading digit or digits) and a leaf (the last digit). This approach enables easy visualisation of the distribution of data.

(5)

SOLUTION 1.10.2

Steps	Explanation
Median = $\frac{32 + 33}{2}$	The median value is the number that is in the middle, with the same number of numbers below and above, if there is an odd amount of numbers.
Median = 32,5	Simplify.

(2)

SOLUTION 1.10.3

Steps	Explanation
Mean $(x) = \frac{648}{20} = 32{,}4$	

(2)

SOLUTION 1.10.4

Steps	Explanation
Mode = 25	To find the mode it is best to put the numbers in order (makes it easier to count them), then count how many of each number. A number that appears most often is the mode.

(1)

SOLUTION 1.11 1.11.1

Steps	Explanation
Range = maximum – minimum	Range refers to the difference between the highest and lowest values in a dataset.
Range = 49 – 2	Substitute the values.
Range = 47	Simplify.

(2)

SOLUTION 1.11.2

Steps	Explanation
2 3 3 6 10 11 11 18 26 29 32 33 35 42 42 47 49 49	Arrange data in ascending order.

(1)

SOLUTION 1.11.3

Steps	Explanation
$Q_1 = 10$	The median of the lower set of data.

(2)

SOLUTION 1.11.4

Steps	Explanation
$Q_3 = 42$	The upper quartile can also be thought of as the median of the upper half of the numbers.

(2)

SOLUTION 1.11.5

Steps	Explanation
$IQR = Q_3 - Q_1$	The Interquartile Range (IQR) refers to the value you get when you subtract the first quartile (Q_1) from the third quartile (Q_3).
IQR = 42 – 10	Substitute the values
IQR = 33	Simplify.

(2)

SOLUTION 1.11.6

Steps	Explanation
Semi-IQR =16	Half of the IQR

(2)

SOLUTION 1.11.7

Steps	Explanation
$P_{40\ position} = \frac{40}{100}(18 + 1) = 7,6$	Find the position of the percentile.
$P_{40} = \frac{1}{2}(11 + 18) = 14,5$	Find the percentile.

(3)

SOLUTION 1.12 1.12.1

Steps	Explanation
26	

(1)

SOLUTION 1.12.2

Steps	Explanation
Mean = $\frac{764}{26}$	A mean is the average of a data.
Mean = 29.385	Simplify.

(2)

SOLUTION 1.12.3

Steps	Explanation
27 28 28 28 28 28 28 28 28 28 28 28 29 29 29 29 30 30 31 31 31 31 32 32 32 33	Arrange the data in ascending order.

(2)

SOLUTION 1.12.4

Steps	Explanation
Median = $\frac{29 + 29}{2}$	The median value is the number that is in the middle, with the same number of numbers below and above, if there is an odd number of numbers.
Median = 29	Simplify.

(2)

SOLUTION 1.12.5

Steps	Explanation
Mode = 28	Value that appears the most.

(1)

SOLUTION 1.13 1.13.1

<table>
<tr><th>Steps</th><th>Explanation</th></tr>
<tr><td>

Stem	Leaf
4	3 9
5	1 6 9
6	0 2
7	5 8 9
8	0 2 4 6 7 8 9
9	4

</td><td>A stem-and-leaf diagram is a method of organising numerical data by splitting each number into a stem (the leading digit or digits) and a leaf (the last digit). This approach enables easy visualisation of the distribution of data.</td></tr>
</table>

(7)

SOLUTION 1.13.2

Steps	Explanation
Min. = 43 Max. = 94	Lowest and highest values

(2)

SOLUTION 1.13.3

Steps	Explanation
43 49 51 56 59 60 62 75 78 79 80 82 84 86 87 88 89 94	Arrange the data in ascending order.
$Q_1 = 59$	The lower quartile can also be thought of as the median of the lower half of the numbers.

(2)

SOLUTION 1.13.4

Steps	Explanation
$Q_3 = 86$	The upper quartile can also be thought of as the median of the upper half of the numbers.

(2)

SOLUTION 1.13.5

Steps	Explanation
IQR = $Q_3 - Q_1$	The Interquartile Range (IQR) is the difference between the third quartile (Q_3) and the first quartile (Q_1).
IQR = 86 – 59	Substitute the value of IQR into the formula.
IQR = 27	Simplify.

(2)

SOLUTION 1.13.6

Steps	Explanation
$Q_{70\text{th position}} = \frac{70}{100}(18 + 1) = 13{,}3$	Find the position.
$Q_3 = 84 + 0{,}3(86 - 84)$	Substitute the values.
$Q_3 = 84{,}6$	Simplify.

(2)

SOLUTION 1.13.7

Steps	Explanation
Range = maximum – minimum	Range refers to the difference between the highest and lowest values in a dataset.
Range = 94 – 43	Substitute the values.
Range = 51	Simplify.

(2)

QUESTION 2: Data representation

SOLUTION 2.1 2.1.1

Explanation	
Tally marks provide a quick method for counting; you draw four vertical lines and add a diagonal fifth line to represent five. By adding up the frequencies, you can check that your totals are accurate.	

Frequency distribution table: Choice of sport		
Sport	Tally	Frequency
Basketball	𝍸	5
Rugby	𝍸 |	6
Soccer	𝍸 𝍸 ||	12
Tennis	||||	4
Volleyball	|||	3
	TOTAL	30

(5)

SOLUTION 2.1.2

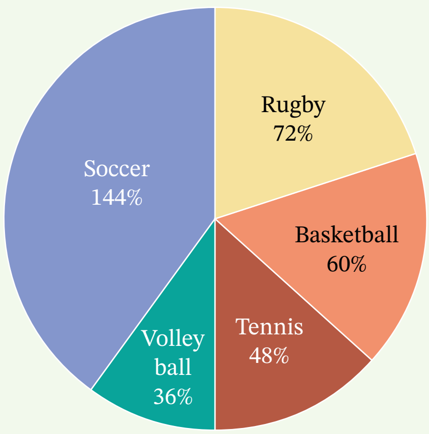
Steps	Explanation
Soccer	

(1)

SOLUTION 2.1.3

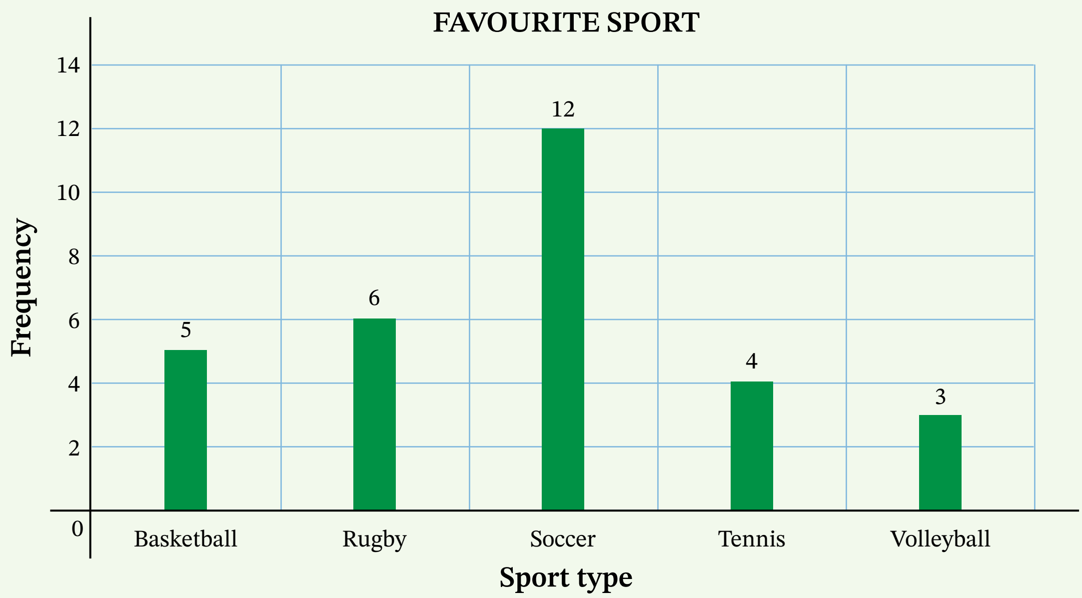
Steps	Explanation

Sport	Frequency	%	Degrees
Basketball	5	16,7%	60°
Rugby	6	20%	72°
Soccer	12	40%	144°
Tennis	4	13,3%	48°
Volleyball	3	10%	36°
TOTAL	**30**	**100%**	**360°**



(5)

SOLUTION 2.1.4

Steps	Explanation
	

(5)

SOLUTION 2.2 2.2.1

Steps	Explanation
see stem-and-leaf table below	A stem-and-leaf diagram is a method of organising numerical data by splitting each number into a stem (the leading digit or digits) and a leaf (the last digit). This approach enables easy visualisation of the distribution of data.

Stem	Leaf
6	3; 6; 7; 8
7	0; 4; 9
8	2; 4
9	0; 1; 5; 5; 5; 5; 5; 9
10	0; 3; 9

(5)

SOLUTION 2.2.2

Steps	Explanation
Mode = 95	Value that appears most often

(2)

SOLUTION 2.2.3

Steps	Explanation
Median = $\frac{90 + 91}{2}$	Arrange the data in ascending order.
= 90,5	Simplify.

(2)

SOLUTION 2.2.4

Steps	Explanation
Range = maximum – minimum	Range refers to the difference between the highest and lowest values in a dataset.
Range = 109 – 63	Substitute the values.
Range = 46	Simplify.

(1)

SOLUTION 2.3 2.3.1

Steps	Explanation
<table><tr><th>Stem</th><th>Leaf</th></tr><tr><td>1</td><td>5</td></tr><tr><td>2</td><td>5, 8</td></tr><tr><td>3</td><td>0, 4, 5, 7, 7, 9</td></tr><tr><td>4</td><td>4, 7</td></tr><tr><td>5</td><td>0, 0, 5, 6, 7, 7, 7, 7, 7</td></tr></table>	A stem-and-leaf diagram is a method of organising numerical data by splitting each number into a stem (the leading digit or digits) and a leaf (the last digit). This approach enables easy visualisation of the distribution of data.

(5)

SOLUTION 2.3.2

Steps	Explanation
Mean = $\frac{867}{20}$	Substitute the values.
= 43,35	Simplify.

(2)

SOLUTION 2.3.3

Steps	Explanation
Median = $\frac{1}{2}(20 + 1)$ position	Note there is an odd number of values in data set.
Position of median = $\frac{1}{2}(20 + 1)$	There are 20 values in the data set.
Position of median =10,5	Find the position of the median.
Median = $\frac{44 + 47}{2}$	Substitute the values.
Median = 45,5	Simplify.

(2)

SOLUTION 2.3.4

Steps	Explanation
Mode = 57	The value that appears the most

(2)

SOLUTION 2.4 2.4.1

Explanation

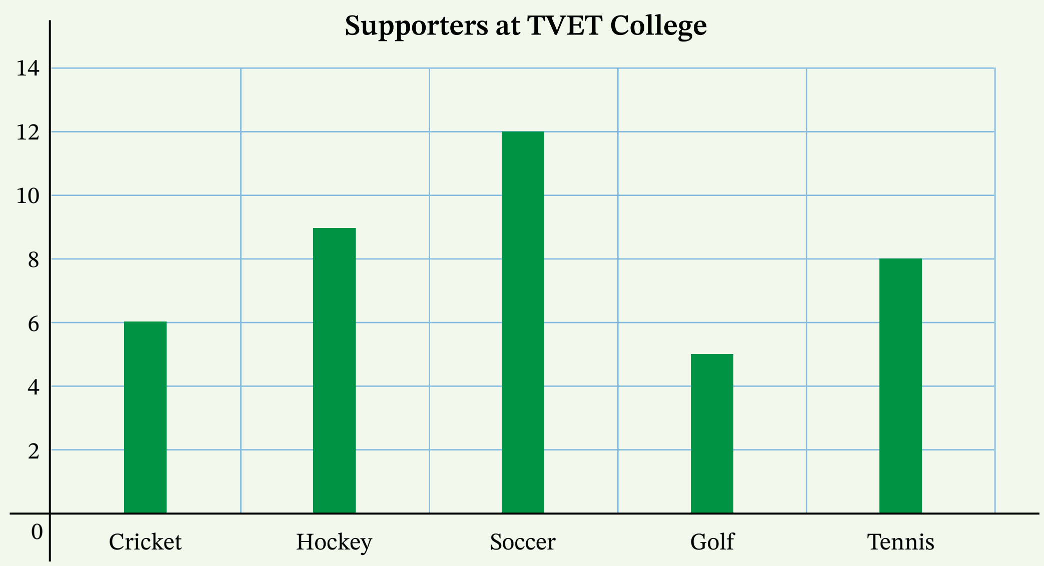
Tally marks provide a quick method for counting; you draw four vertical lines and add a diagonal fifth line to represent five. By adding up the frequencies, you can check that your totals are accurate.

Sports	Tally	Frequency
Cricket	卌 I	6
Hockey	卌 IIII	9
Soccer	卌 卌 II	12
Golf	卌	5
Tennis	卌 III	8
	TOTAL	**40**

(5)

SOLUTION 2.4.2

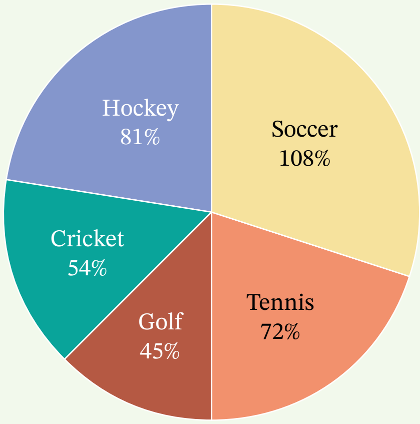
Steps	Explanation



One mark for each correct bar

(5)

SOLUTION 2.4.3

Steps	Explanation
	One mark for each 'wedge/slice'

(5)

SOLUTION 2.5 2.5.1

<table><tr><th>Steps</th><th>Explanation</th></tr><tr><td>

Stem	Leaf
5	0, 7, 7, 9
6	3, 5, 9
7	0, 0, 0, 4, 7
8	5, 6
9	2, 3, 5, 7, 8, 9

</td><td>A stem-and-leaf diagram organises numbers by dividing each value into a stem, made up of the leading digit or digits, and a leaf, which is the final digit. This makes it easier to visually understand how the data is distributed.</td></tr></table>

(5)

SOLUTION 2.5.2

Steps	Explanation
Mean = $\frac{1\,526}{20}$	A mean is the average of a data.
Mean = 76,3	Add the values and divide by 20. There are 20 values in the data set.

(2)

SOLUTION 2.5.3

Steps	Explanation
Position of median = $\frac{1}{2}(20 + 1)$ = 10,5 position	Note there is an odd number of values in data set. There are 20 values in the data set
Median = $\frac{70 + 74}{2}$ = 72	Substitute the values and find the value in the middle.

(2)

SOLUTION 2.5.4

Steps	Explanation
Mode = 70	Value that appears most.

(1)

SOLUTION 2.6 2.6.1

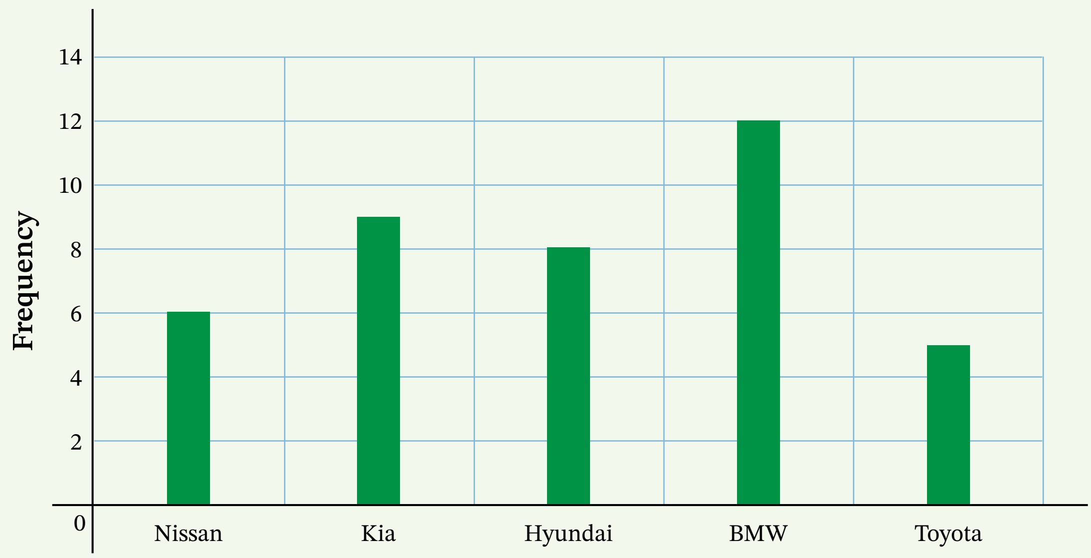
Explanation

Tally marks are used in various settings, such as keeping track of scores in games, recording attendance, or counting inventory. The visual grouping by fives makes it easy to scan and quickly add up large quantities without recounting each mark individually.

Cars	Tally	Frequency
NISSAN	~~||||~~ |	6
HYUNDAI	~~||||~~ |||	8
BMW	~~||||~~ ~~||||~~ ||	12
KIA	~~||||~~ ||||	9
TOYOTA	~~||||~~	5
	TOTAL	**40**

(5)

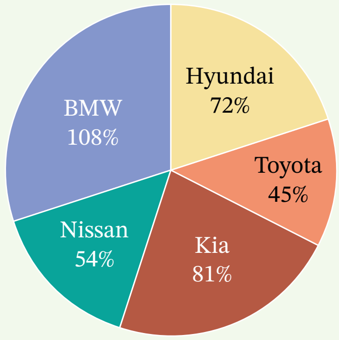
SOLUTION 2.6.2



(5)

SOLUTION 2.6.3

Cars	Frequency	Percentage	Degree
NISSAN	6	15%	54°
HYUNDAI	8	20%	72°
BMW	12	30%	108°
KIA	9	22,5%	81°
TOYOTA	5	12,5%	45°
TOTAL	40	100%	360°



½ for each degree + ½ for each correct sector

(5)

SOLUTION 2.7 2.7.1

Stem	Leaf
5	0, 7, 7, 9
6	3, 5, 9
7	0, 0, 0, 4, 7
8	5, 6
9	2, 3, 5, 7, 8, 9

A stem-and-leaf diagram is a method of organising numerical data by splitting each number into a stem (the leading digit or digits) and a leaf (the last digit). This approach enables easy visualisation of the distribution of data.

(5)

SOLUTION 2.7.2

Steps	Explanation
Mean = $\frac{1\,526}{20}$	Substitute the values.
Mean = 76,3	Simplify.

(2)

SOLUTION 2.7.3

Steps	Explanation
Position of median = $\frac{1}{2}(20 + 1)$ Position of median = 10,5	Note there is an odd number of values in data set.
$= \frac{70 + 74}{2}$	Substitute the values to determine the value in the middle.
Median = 72	Do a quick check to see if the value you calculated is in the centre of the arranged data set.

(2)

SOLUTION 2.7.4

Steps	Explanation
Mode = 70	Mode is the value that appears the most.

(1)

SOLUTION 2.8 2.8.1

Explanation

Tally marks are a fast way to count by drawing four vertical lines, then striking a fifth line diagonally to indicate five. You can add the frequencies to ensure it all add up correctly.

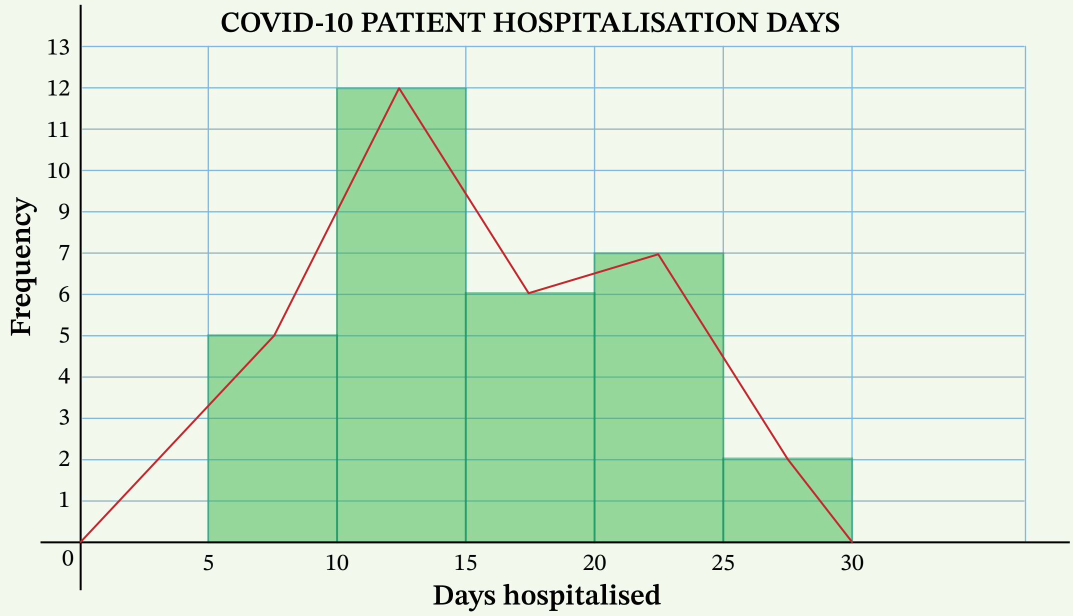
Days (n) hospitalised	Tally	Frequency
$5 < n \leq 10$	卌	5
$10 < n \leq 15$	卌 卌 ||	12
$15 < n \leq 20$	卌 |	6
$20 < n \leq 25$	卌 ||	7
$25 < n \leq 30$	||	2
	TOTAL	**32**

(5)

SOLUTION 2.8.2 and 2.8.4

Explanation

Note that a histogram represents continuous data, so the bars touch each other. The frequency polygon is the lines that join the centre of the bars. You must label the axes.



(17)

SOLUTION 2.8.3

Steps	Explanation
The modal class is $10 < n \leq 15$	Look at the interval with the highest frequency.

(1)

SOLUTION 2.9 2.9.1 and 2.9.2

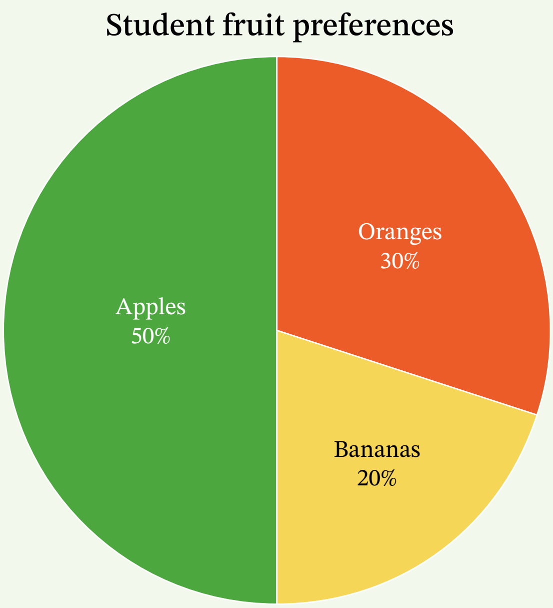
Explanation

Tally marks are a quick method for recording numbers. They are used for counting by drawing four vertical lines; one for each of the first four counts and then a fifth line is drawn diagonally across them to represent the number five.

Fruit	Tally	Frequency	Frequency percentage
Apples	卌 卌 卌	15	50%
Bananas	卌 |	6	20%
Oranges	卌 ||||	9	30%
	TOTAL	**30**	**100%**

(7)

SOLUTION 2.9.3



(7)

SOLUTION 2.10 2.10.1

Explanation

Tally marks are a fast way to count data. Draw four vertical lines for one to four, then cross them with a diagonal line for five.

Dog breed	Tally	Frequency
Labrador	𝍸 |||	8
Husky	𝍸 𝍸 |||	13
Jack Russell	𝍸 |	6
Pug	𝍸 |||	8
Fox Terrier	𝍸	5
	TOTAL	**40**

(5)

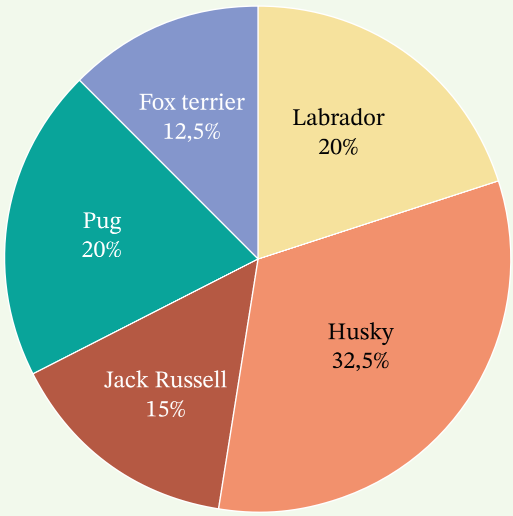
SOLUTION 2.10.2

Steps	Explanation
Husky	

(1)

SOLUTION 2.10.3

Steps	Explanation
Labrador: $\frac{8}{40} \times 360° = 72°$	Calculate the angle of the sector. Note that one circle is equal to 360°.
Percentage: $\frac{8}{40} \times 100 = 20\%$	
Husky: $\frac{13}{40} \times 360° = 117°$	
Percentage: $\frac{13}{40} \times 100 = 32{,}5\%$	
Jack Russell: $\frac{6}{40} \times 360° = 54°$	
Percentage: $\frac{6}{40} \times 100° = 15°$	
Pug: $\frac{8}{40} \times 360° = 72°$	
Percentage: $\frac{8}{40} \times 100 = 20\%$	
Fox terrier: $\frac{5}{40} \times 360° = 45°$	
Percentage: $\frac{5}{40} \times 100° = 12{,}5\%$	



(7)

Question papers Maths L2

Introduction to Paper 1 and Paper 2

Proposed mark distribution between Paper 1 and Paper 2 for external examination papers

Paper 1	
Topics	**Marks**
1. Numbers	30
2. Functions and Algebra	
2.1 Functions	25
2.2 Algebra	25
5. Financial Mathematics	20
Total	**100**

Paper 2	
Topics	**Marks**
3. Space, Shape and Measurement	
3.1 Geometry	30
3.2 Trigonometry	30
4. Data Handling	40
Total	**100**

Formula sheets

Paper 1

Paper 2

Chapter 5: **Financial Mathematics**
(Paper 1)

QUESTION 1: Personal and household finances (financial concepts, budgets)

SOLUTION 1.1

Steps	Explanation
1.1.1 G	A credit card is a bank card used to regulate transactions from bank accounts with money to spend; offers an overdraft for unexpected, urgent expenses.
1.1.2 D	Fixed deposit is the money invested in a bank for a specific period of time at a fixed rate of interest.
1.1.3 H	A bursary is the money paid to students in order to complete a course of study at an institution of learning.
1.1.4 C	An audit is a formal examination of an organisation's financial statements.
1.1.5 A	Variance is the difference between budgeted and actual amounts.
1.1.6 B	A summary of a assets and liabilities as at a specific date.

(6)

SOLUTION 1.2

Steps	Explanation
1.2.1 H	Savings account is an account opened at a bank into which money can be paid and withdrawn from.
1.2.2 D	Fixed investment is the money invested in a bank for a specific period at a fixed rate of interest.
1.2.3 A	A unit trust is a form of collective investment constituted under a trust. It is a medium- to long-term investment that is aimed at beating inflation.
1.2.4 B	A short-term investment is an investment where the benefits can be used after a short term, for example one year.
1.2.5 C	A debit card is a bank card that is used to regulate transactions from a bank account containing money to spend.

(5)

SOLUTION 1.3 1.3.1

Steps	Explanation
R180 + (0,15 × R180)	The family's expenditure on water and electricity was R180 per month, during the previous year, and they for an increase of 15%.
= R180 + R27	Simplify.
= R207	Use you calculator and determine the value.

(2)

SOLUTION 1.3.2

Steps	Explanation
R60 × 2 = R120	School fees are R60 per month per learner. The family has two children and they pay school fees monthly.

(1)

SOLUTION 1.3.3

Steps	Explanation
C = R12 184 – (R7 150 + R534) + R1 550	Sipho's mother's monthly salary (C) if the family has a surplus of R1 550 at the end of the month.
= R6 050	Calculate the value.

(2)

SOLUTION 1.4 1.4.1

Steps	Explanation
Balance still owing = R2 699,00 – (0,01 × R2 699,00)	Subtract the deposit from the price of the fridge. Note: 10% = $\frac{10}{100}$ = 0,01
= R2 699,00 – R269,90	Simplify.
= R2 429,10	Simplify.

(2)

SOLUTION 1.4.2

Steps	Explanation
Total amount = R269,90 + (24 × R177,53)	Add the deposit and the 24 monthly instalments.
Total amount = R 269,90 + R4 260,72	Simplify.
Total amount = R4 530,62	Simplify.

(3)

SOLUTION 1.5

Steps		Explanation
1.5.1	D	A credit card is used to get goods before they are paid for.
1.5.2	E	The variance is the difference between the budgeted amount and actual amount.
1.5.3	F	The initial amount of money that is put into an investment or is borrowed.
1.5.4	G	A budget is the plan of your monthly income and expenditures to manage your finances.
1.5.5	A	All the money you can earn or receive.
1.5.6	C	The interest rate is the percentage that regulates the interest you will receive on your savings or will have to pay on hire purchase amounts and overdrafts.

(6)

SOLUTION 1.6

Steps		Explanation
A	R332,50	9,5% × R3 500 = R322,50
B	R105,00	Azania Fashion = R300 – R195 = R105
C	R1 350,00	Cost for food = 30 days × R45 = R 1 350
D	R440,00	R110 per weekend for entertainment: 4 × R110 = R440 for entertainment
E	R1 087,50	R3 500 – (R322,50 + R300 + R1 350 – R440)

(5)

SOLUTION 1.7

Steps			Explanation
1.7.1	B	An interest-bearing account held at a bank or other financial institution.	Saving account is an interest-bearing account held at a bank.
1.7.2	F	Money invested in a bank for a specific period.	Fixed deposit is money invested in a bank for a specific period.
1.7.3	E	A collective investment fund that is bought and sold in units.	Unit trust is a collective investment fund that is bought and sold in units.
1.7.4	C	Financial investments that can easily be converted to cash, typically within 5 years	Short-term investment is a financial investment that can easily be converted to cash, typically within 5 years.
1.7.5	D	Used to make payments for purchases so that money is immediately deducted from the consumer's account.	Debit card is used to make payments for purchases so that money is immediately deducted from the consumer's account.
1.7.5	A	Money paid to the bank for the services it renders.	Bank fees are the money paid to the bank for the services it renders.

(6)

SOLUTION 1.8

Income and Expenditure Statement of Mamashele, a farm worker	
INCOME	**AMOUNT**
Nett wage	
170 hours @ R50 per hour	R8 500
Net monthly earnings	R8 500
EXPENDITURE	AMOUNT
Rental of flat	R2 200
Transport	R414
Cellphone	R147
Groceries	R1 800
Clothing	R460
Entertainment	R400
Laundry service	R250
Total monthly expenditure	**R5 671**
Amount left after all the expenses have been paid	**R2 829**

(6)

SOLUTION 1.9

Steps	Explanation
1.9.1 G	Amount of money spent or used to buy or do something.
1.9.2 E	Itemised summary of expected income and expenses over a specified period.
1.9.3 D	Expense that varies from month to month.
1.9.4 C	Financial statement described as a snapshot of a company's financial position.
1.9.5 B	Difference between the actual amount and the budgeted amount in a budget.

(5)

SOLUTION 1.10

Steps	Explanation
1.10.1 The R300 variance in expenses under *Books and Stationery* shows that he spent less than what he planned, which is favourable.	In finance, *variance* is a statistical measure that quantifies the difference between expected and actual values.
1.10.2 unfavourable	A negative in the income column shows that the income is less than expected.
1.10.3 Adriaan will have a surplus of R385 at the end of the month.	Surplus is the extra amount left at end of month.
1.10.4 The variance is zero.	

(6)

SOLUTION 1.11

Steps	Explanation
1.11.1 A R92 060,00 – R96 000,00 = –R3 940,00 B R97 490,00 – R91 500,00 = R5 990,00	Find the difference in the amounts.
1.11.2 R92 060 – R97 490 = –R5 430	The answer must be negative as it is a deficit.
1.11.3 (a) Variance = R13 350 – R16 000 Variance = –R2 650	
(b) It is a favourable scenario.	

(5)

SOLUTION 1.12

Steps	Explanation
1.12.1 G	Expenses that stay the same and are paid regularly
1.12.2 E	Money put in a business enterprise or a financial institution
1.12.3 B	The difference between the actual and projected amounts in a budget
1.12.4 D	A card issued by a bank to enable the holder to pay for purchases, where the money is transferred directly from the holder's account to the seller
1.12.5 A	The fees normally associated with services rendered by bank.

(5)

QUESTION 2: Simple and compound interest

SOLUTION 2.1

Steps	Explanation
A = P[1 + *in*]	Use the simple interest formula.
A = 5 000[1 + 0,06 × 5]	Substitute values into the simple interest formula. P = 5 000 $i = \frac{6}{100} = 0,06$ *n* = 5 years
A = 5 000[1,3]	Simplify inside the brackets.
A = 6 500	Simplify.

(5)

SOLUTION 2.2

Steps	Explanation
A = P[1 + *in*]	Use the simple interest formula.

SOLUTION 2.2.1

Steps	Explanation
A = P[1 + *in*]	Use the simple interest formula.
A = 10 500[1 + 0,11 × 3]	Transfer the given information into symbols related to the simple interest formula. Substitute values into the simple interest formula. Convert the interest percentage to a decimal by dividing it with 100.
A = 10 500[1,33]	Simplify inside the brackets.
A = 13 965	Make sure you answer is meaningful and reasonable.

(5)

SOLUTION 2.2.2

Steps	Explanation
The monthly repayments $= \frac{13\ 965}{36}$	The monthly repayments $= \frac{\text{Total money paid}}{\text{Total number of months}}$
= 387,917	Simplify.

(2)

SOLUTION 2.2.3

Steps	Explanation
The total interest paid = 13 965 – 10 500	The total interest paid = total money paid – cash price
= 3 465	Simplify.

(2)

SOLUTION 2.3

Steps	Explanation
Deposit = $\frac{10}{100}$ × R19 000	Deposit = 10% of R19 000
Deposit = R1 900	Simplify.
Amount financed = R19 000 – R1 900 = R17 100	Subtract the amounts.
$A = P(1 + in)$	Use the simple interest formula.
A = 17 100[1 + (0,12 × 3)]	Substitute values into the simple interest formula.
A = R23 256	
Total amount paid = R1 900 + R23 256 + R(35 × 3 × 12)	Find the total insurance.
= R26 416	Simplify.

(5)

SOLUTION 2.4

Steps	Explanation
$A = P(1 + i)^n$	Use the compound interest formula.
$1\,466 = 1\,300(1 + i)^3$	Substitute values into interest formula.
$\frac{1\,466}{1\,300} = (1 + i)^3$	Isolate the brackets.
$1.12769 = (1 + i)^3$	Simplify.
$1 + i = \sqrt[3]{1.12769}$	Simplify.
$i = 0.0409$	Find the interest rate.
$r = 0.0409 \times 100 = 4.09\%$	Write the interest rate as a percentage.

(4)

SOLUTION 2.5 2.5.1

Steps	Explanation
$A = P(1 + in)$	Use the simple interest formula.
A = 2 500[1 + (0,12 × 5)]	Substitute values into the simple interest formula. Note: i = 12% = 0,12
A = R4 000	Simplify.

(2)

SOLUTION 2.5.2

Steps	Explanation
A = P(1 + *in*)	Write down the formula for compound interest.
$A = 2\ 500(1 + 0.1)^5$	Substitute values into the formula.
A = R4 026,28	Simplify.

(2)

SOLUTION 2.5.3

Steps	Explanation
Compound interest is better than simple interest because it yields more interests, which means that Bokamoso made more money than Boikgantsho.	Compound interest generally earns more money over time because interest is added to the principal amount, increasing future returns.

(1)

SOLUTION 2.6 2.6.1

Steps	Explanation
A = P(1 + *in*)	Write down the formula for simple interest.
A = 12 000(1 + 0,16 × 5)	Substitute the values into the formula. P = R12 000 *i* = 16% *n* = 5 years
A = R21 600	Simplify.

(2)

SOLUTION 2.6.2

Steps	Explanation
I = 21 600 – 12 000	Find the difference between the amounts.
I = R9 600	Simplify.

(2)

SOLUTION 2.6.3

Steps	Explanation
$A = P(1 + i)^n$	Write down the formula for compound interest.
$= 12\ 000(1 + 0{,}16)^5$	Substitute the values into the formula.
= R25 204,10	Simplify and round off to two decimal places.

(2)

SOLUTION 2.6.4

Steps	Explanation
I = A – P	Write the formula.
= R25 204,10 – 12 000,00	Find the difference between the amounts.
= R13 204,10	

(2)

SOLUTION 2.6.5

Step	Explanation
Compound interest is better than simple interest because it yields more interest.	Compound interest tends to generate greater earnings over time, since the interest is continually added to the original amount, resulting in higher future gains.

(1)

SOLUTION 2.7 2.7.1

Steps	Explanation
10% of the amount $= \frac{10}{100} \times 5\ 600 = \text{R}560$	Determine 10% of the amount.
R5 600 – R560 = R5 040	Subtract the deposit from the amount.

(2)

SOLUTION 2.7.2

Steps	Explanation
Monthly instalments $= \frac{\text{R}6\ 552{,}00}{24}$ = R273,00	

(3)

SOLUTION 2.7.3

Steps	Explanation
$A_t = A_0\left(1 + \frac{r}{100}\right)^n$	
$A_0 = 5\ 600 = \frac{\text{R}4\ 891{,}26}{1.1229}$	
= R4 891,26	

(4)

SOLUTION 2.8 2.8.1

Steps	Explanation
$AA_t = A_o\ (1 + \frac{r}{100}t)$	
$A_t = 15\ 000\left(1 + \frac{18}{100}\ (3)\right)$	
A_t = R23 100	

(3)

SOLUTION 2.8.2

Steps	Explanation
$A_t = A_o\left(1 + \frac{r}{100}\right)^n$	
$18\ 017{,}36 = 15\ 000\left(1 + \frac{18}{100}\right)^3$	
$A_t = 15\ 000(1{,}643)$	
A_t = R24 645,48	

(4)

SOLUTION 2.8.3

Steps	Explanation
$A_t = A_o\left(1 + \frac{r}{100}\right)^n$	
$18\ 017{,}36 = 15\ 000\left(1 + \frac{r}{100}\right)^3$	
$\frac{18\ 017{,}36}{1\ 500} – \left(1 + \frac{r}{100}\right)^3$	
$\left(\frac{(18\ 017{,}36)}{1\ 500}\right)^{\frac{1}{3}} – 1 = \frac{r}{100}$	
$1,\ 063 – 1 = \frac{r}{100}$	
$\therefore\ r = 6{,}3\%$	

(3)