higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MATHEMATICS N2

(16030192)

31 March 2020 (X-paper)
09:00–12:00

REQUIREMENTS: 2 sheets of graph paper (BOE 8/9)

Calculators may be used.

This question paper consists of 7 pages and a formula sheet of 2 pages.

034Q1A2031

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE
MATHEMATICS N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Show all intermediate steps and simplify where possible.
5. Use only blue or black ink.
6. Write neatly and legibly.

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QUESTION 1

1.1 Simplify the following WITHOUT using a calculator:

1.1.1 $\left[\sqrt{\frac{23x^{9}}{46x^{-2}}}\right]^{0}$ (1)

1.1.2 $\log_{\sqrt{x}}\sqrt{x}$ (1)

1.1.3 $\frac{\sqrt{\sqrt[3]{64p^{30}q^{36}}}}{2p^{-2}q^{-5}}$ (3)

1.1.4 $\frac{\log 9-\log 4}{\log 81-\log 16}$ (3)

1.2 Solve for x in the following equations:

1.2.1 $\frac{16^{x+2}}{64^{2x+1}}=256$ (4)

1.2.2 $\frac{1}{2}\log_{7}\frac{1}{49}=x$ (3)

[15]

QUESTION 2

2.1 Given the following algebraic expressions:

$a^{2}-6ab+9b^{2}$
$a^{2}-9b^{2}$
$a^{2}-3ab$
$3a^{2}-6ab-9b^{2}$

2.1.1 Fully factorise each expression (8)

2.1.2 Determine the LCM of all four expressions. (4)

2.2 Simplify the following algebraic fractions:

2.2.1 $\frac{5x^{2}+6x-8}{3x+6}\div\frac{50x^{2}-32}{3x^{2}-12}\times\frac{2}{x-2}$ (4)

2.2.2 $\frac{3}{3-x}-\frac{x}{6+x-x^{2}}$ (4)

[20]

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QUESTION 3

3.1 Solve for q given that

$$-2=\sqrt{3-4q}$$ (2)

3.2 Solve for x by using the quadratic formula:

$x^2-4x=2$. The final answer must be rounded off to THREE decimal places (3)

3.3 Five pears and two apples cost R16,50 while three pears and four apples cost R18,50.

What is the cost of one pear and one apple? (4)

3.4 Given $A=\pi\left(R^2-r^2\right)$

Make r the subject of the formula (3)

3.5 Given $D=h+\frac{x^2}{4h}$

Make x the subject of the formula (3)
[15]

QUESTION 4

4.1 KFC intends to start selling milkshake in a crispy conical-shaped cup with a surface area of $315\,\text{cm}^2$ and a slant height of 15cm.

Calculate each of the following:

4.1.1 Radius of the cup (3)

4.1.2 Perpendicular height of the cup (2)

4.1.3 Quantity of milkshake that will fill the cup (2)

4.2 The coordinates of the points on a curve are given in the table below.

Calculate the area of the irregular shape

x	0	3	6	9	12	15	18	21
y	5	10	60	70	40	20	12	6

(3)

4.3 Given the functions $f: 3x + y = 6$ and $g: \frac{x}{3} - \frac{y}{2} = 1$

4.3.1 Draw (ON GRAPH PAPER) the functions f and g on the same system of axes clearly indicating the intercept with the axes. (4)

4.3.2 Provide the coordinates of the point of intersection between the graphs drawn in QUESTION 4.3.1 (1)

4.4 The graphs $f: y = 3x^2 - 6x - 9$ and $g: \frac{x}{-3} - \frac{y}{6} = 1$ are shown in FIGURE 1 below.

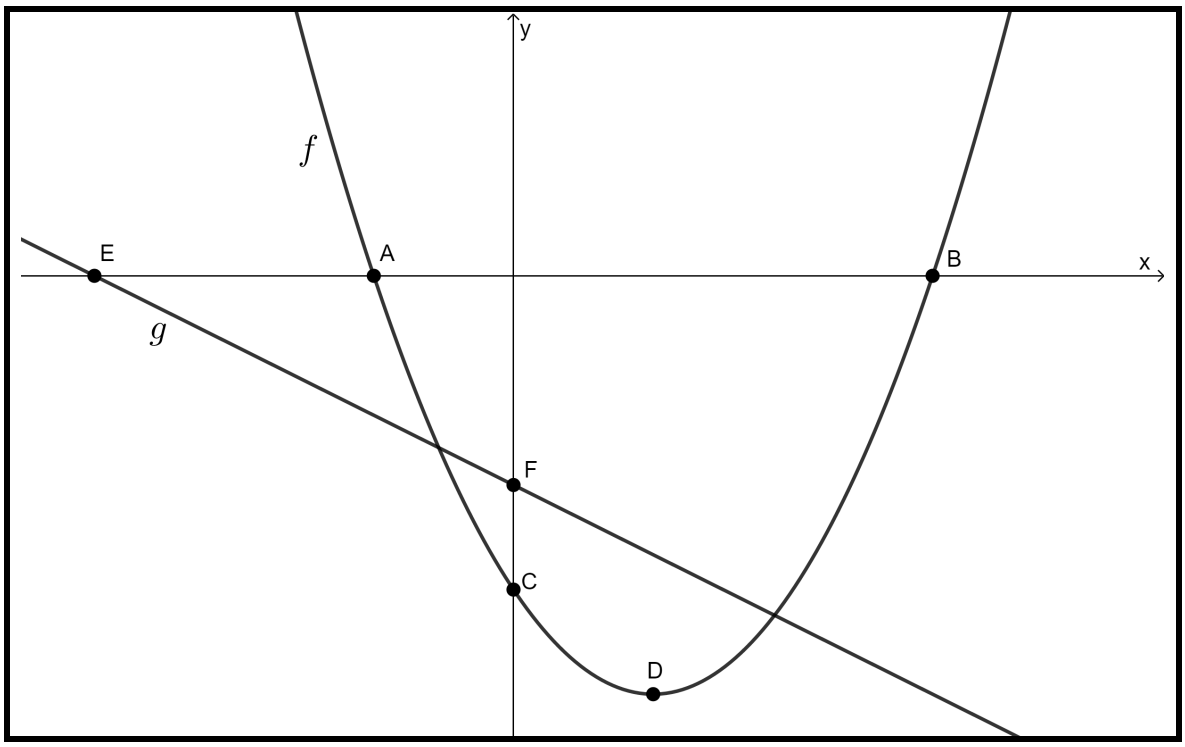


FIGURE 1

Determine each of the following coordinates:

4.4.1 A and B (x-intercepts of f) (2)

4.4.2 C (y-intercepts of f) (1)

4.4.3 D (turning point of f) (2)

4.4.4 E (x-intercepts of g) (1)

4.4.5 F (y-intercepts of g) (1)

[22]

QUESTION 5

5.1 Convert $78{,}3°$ to degrees and minutes. (1)

5.2 Determine the following without using a calculator, if $\sec\alpha = -\frac{13}{12}$ where $90° \leq \alpha \leq 180°$

5.2.1 $1 - \cot\alpha$ (3)

5.2.2 $\sin^2\alpha + \cos^2\alpha$ (2)

5.3 From the point on the ground where a policeman is standing (P), the angle of elevation to two criminals at the third (X) and sixth (Y) floors of a tall building is 21º and 39º respectively.

If the policeman is 18 m from the foot of the building (B), how far apart are the two criminals (XY)?

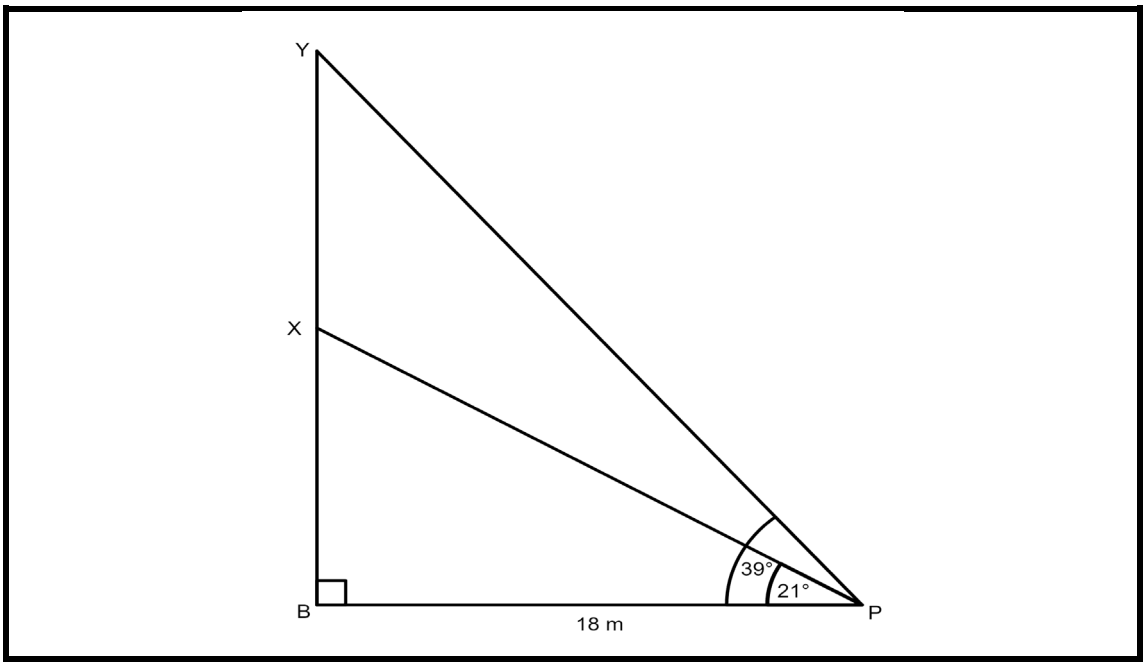


FIGURE 2 (5)

5.4 Given the function $y = \sin x - 2$ for $0° \leq x \leq 180°$

5.4.1 Draw the graph on its own system of axes on the graph paper. (3)

5.4.2 Read from the graph the value(s) of x for which $y = -\frac{3}{2}$. (2)

[16]

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QUESTION 6

6.1 Convert $7{,}555$ radians to degrees. (1)

6.2 The peripheral velocity of a wheel with a diameter of $\frac{3}{4}$ m is 5 m/s.

Determine the following:

6.2.1 The number of revolutions completed per second (2)

6.2.2 The number of revolutions completed per minute (1)

6.3 A sector is cut off from a circle with a diameter of 14cm.

Calculate the area of the sector in cm^2 if it subtends an angle of 75^o at the centre of the circle. (4)

6.4 The length of a chord in a circle is 6 cm and the diameter of the circle is 9 cm

Calculate the height of the minor segment and major segment of the circle. (4)
[12]

TOTAL: 100

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MATHEMATICS N2

INFORMATION SHEET

Any applicable formulae not found on this formula sheet may also be used

Right cone

$$\text{Volume} = \frac{1}{3}\pi r^2 h$$

$$\text{Surface area} = \pi r\sqrt{h^2 + r^2} + \pi r^2$$
$$= \pi r l + \pi r^2$$

Cylinder

$$\text{Volume} = \pi r^2 h$$

$$\text{Surface area} = 2\pi r^2 + 2\pi r h$$

Sphere

$$\text{Volume} = \frac{4}{3}\pi r^3$$

$$\text{Area} = 4\pi r^2$$

Right pyramid

$$\text{Volume} = \frac{1}{3}(\text{area of base}) \times (\text{perpendicular height})$$

Prism

$$\text{Volume} = (\text{area of base}) \times (\text{perpendicular height})$$

Degrees and radians

$180° = \pi$ rad

Sector: $\theta = \dfrac{\text{arc}}{\text{radius}}$; $A = \dfrac{1}{2} r^2 \theta$

Angular velocity and circumferential velocity

Angular velocity: $\omega = 2\pi n$

Circumferential velocity: $v = \pi D n$

n = rotation frequency (r/s = revolution per second)

Midordinate rule

$$\text{Area} = (\text{distance between ordinates}) \times (\text{sum of other midordinates})$$

$$\text{Area} = \left[\frac{(\text{First ordinate} + \text{Last ordinate})}{2} + \text{Sum of all other ordinates}\right] \times \text{The distance between the ordinates}$$

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Graphs

Straight line: $y = mx + c$

Parabola: $y = ax^2 + bx + c$

Axis of symmetry: $x = \dfrac{-b}{2a}$

Roots: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometry

$90° < \theta < 180°$

$\sin\theta = \sin(180° - \theta)$ $\cos\theta = -\cos(180° - \theta)$ $\tan\theta = -\tan(180° - \theta)$

Segment of circles

Chord length = x Height of the segment = h Diameter of circle = D

$D = h + \dfrac{x^2}{4h}$

Regular polygons

Angle subtended at centre of circumscribed circle by one side:

$\theta = \dfrac{360°}{\text{number of sides}}$

R = radius of circumscribed by circle
x = length of the side

$x = 2R\sin\left(\dfrac{\theta}{2}\right)$

Annulus: $A = \pi\left(R^2 - r^2\right)$

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