higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(Second paper)

NQF LEVEL 3

(10501053)

11 November 2024 (X-paper)
09:00–12:00

Scientific calculators may be used.

This question paper consists of 8 pages, a formula sheet of 2 pages and 2 answer sheets.

047Q2N2411

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
MATHEMATICS
NQF LEVEL 3
(Second paper)
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. Clearly show all calculations, diagrams, graphs, etc. used in determining the answers
5. Round off answers to THREE decimal places unless stated otherwise.
6. Diagrams are not drawn to scale.
7. Detach the ANSWER SHEETS from the question paper and submit with your answer booklet.
8. Write neatly and legibly.

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QUESTION 1

1.1 The table below shows the number of times students in a Level 3 class were marked present during the first 25 days of term 3.

Student	1	2	3	4	5	6	7	8	9	10	11	12	13
Number of days	16	14	17	12	23	24	0	19	4	12	17	14	16

1.1.1 Determine the five-number summary of the data. (4)

1.1.2 Calculate the values of the upper and lower fences. (4)

1.1.3 Construct the box and whisker plot for the data on ANSWER SHEET 1 (attached), clearly showing the five-number summary, the fences and any outliers. (5)

1.1.4 Identify and give one possible reason for any outlier/s. (2)

1.2 A survey was conducted among 50 students. The number of hours spent by each student watching TV during a particular fortnight were recorded as follows:

	Frequency f_i	Midpoint x_i	$f_i x_i$	< Cumulative Frequency
$0 \leq x < 20$	5	10	50	5
$20 \leq x < 40$	11	30	330	***d***
$40 \leq x < 60$	24	50	1200	40
$60 \leq x < 80$	8	70	560	48
$80 \leq x < 100$	***a***	90	***b***	50
TOTAL	$\sum f_i = 50$		$\sum f_i x_i =$ ***c***	

1.2.1 Complete the frequency table. Write your answers in the spaces marked (a.) to (d.) on ANSWER SHEET 1 (attached). (4)

1.2.2 Use values obtained from the table to estimate the mean number of hours spent by students watching TV. (2)

1.2.3 Construct an ogive using the less than cumulative frequency and upper-class limits on ANSWER SHEET 2 (attached). (4)

1.2.4 Determine the median of the data from your graph. Clearly show by means of lines on the graph how the median is obtained. (3)

1.2.5 Calculate the mode of the data using an appropriate formula. (3)

[31]

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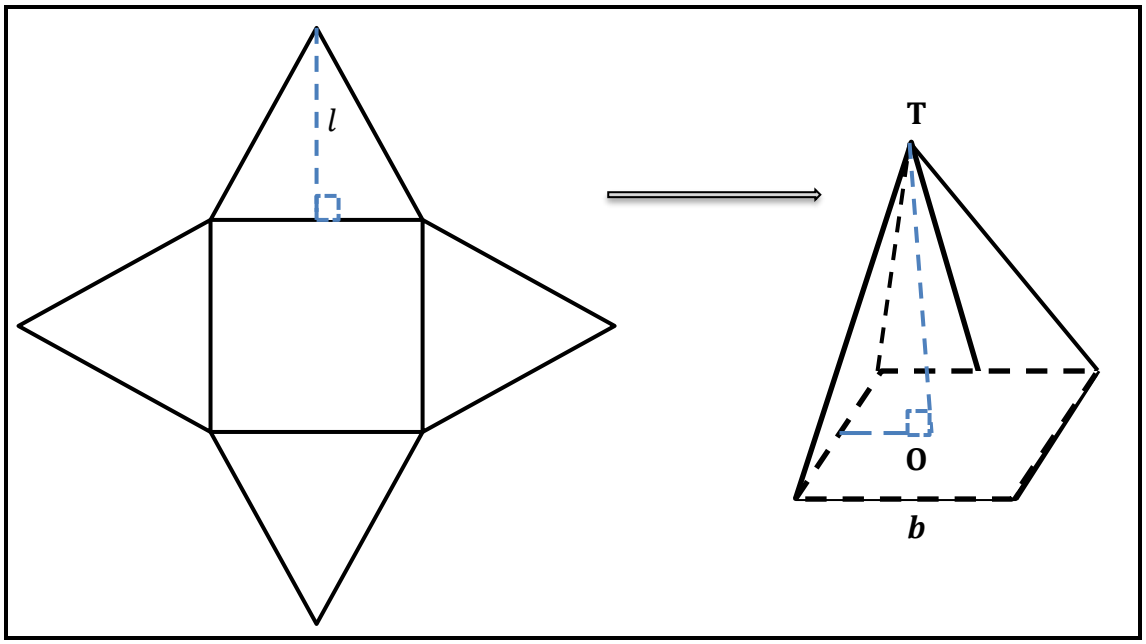
QUESTION 2

2.1 For one of their practical assessment tasks, level 3 welding students at a college are required to make a model of a square-based pyramid. The requirements of the model are:

- Base area of 196 cm^2
- Slant height $l = 15$ cm



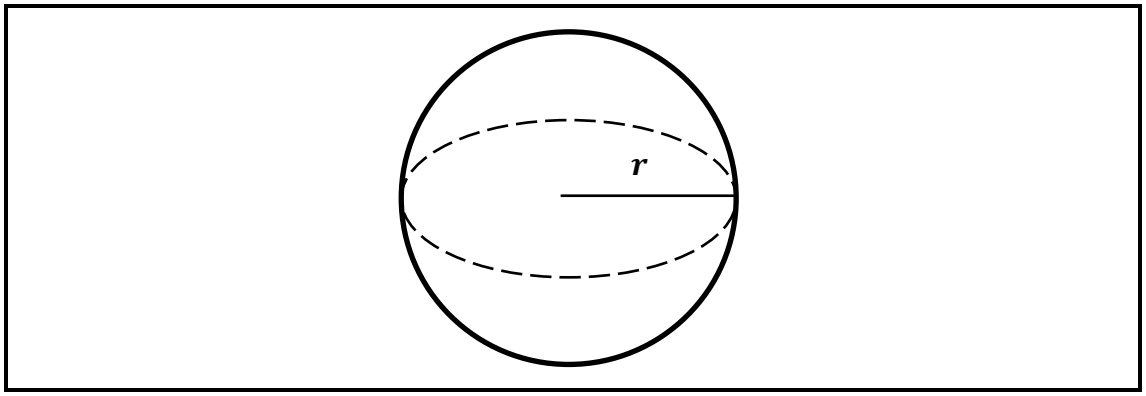
2.1.1 Calculate the length b, of each side of the square base. (2)

2.1.2 Calculate the total surface area of the square pyramid. (3)

2.1.3 Determine the length of OT, the perpendicular height of the square pyramid. (2)

2.1.4 Calculate the volume of the square pyramid. (2)

2.2 A sphere of surface area 2 050 m^2 is shown below.



2.2.1 Calculate the radius r of the sphere. (3)

2.2.2 Calculate the volume of the sphere. (2)

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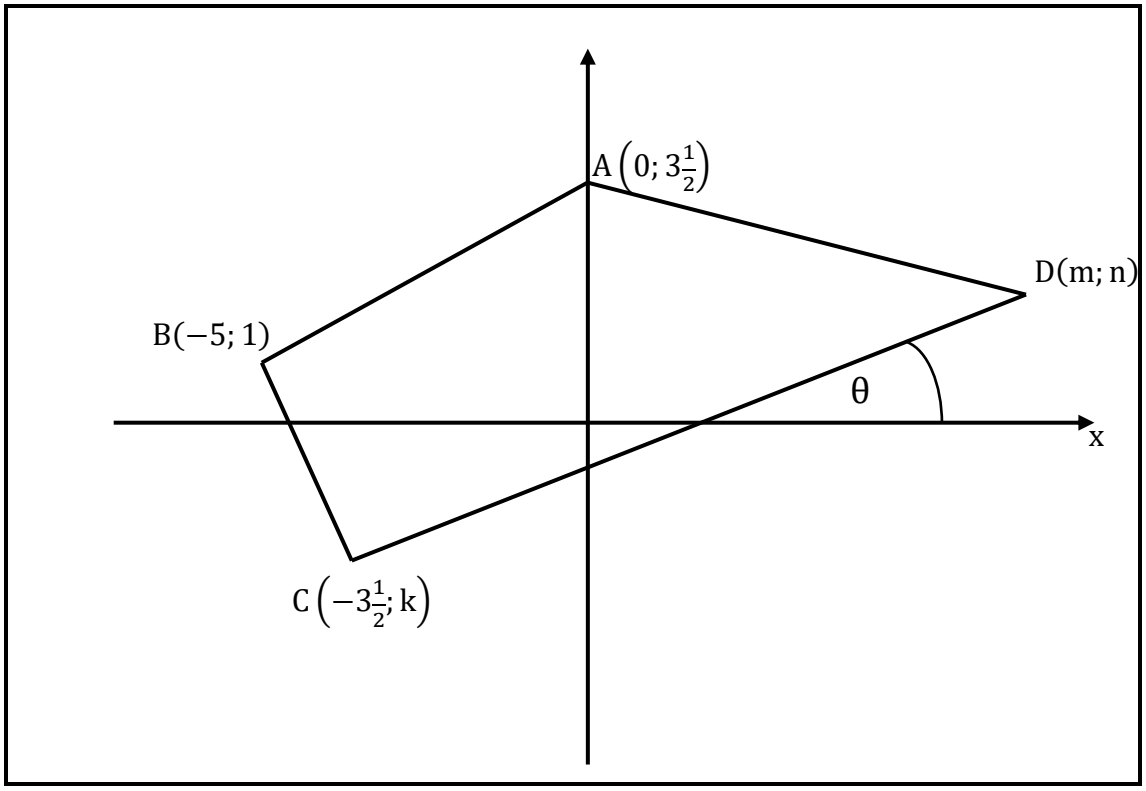
2.3 In the diagram below, the points $A\left(0; 3\frac{1}{2}\right)$, $B(-5; 1)$, $C\left(-3\frac{1}{2}; k\right)$ and D form a quadrilateral ABCD.



2.3.1 Calculate the gradient of AB. (2)

2.3.2 If BC is perpendicular to AB, determine the value of k. (3)

2.3.3 Determine the equation of line CD, given that it is parallel to AB. (3)

2.3.4 Determine the size of angle θ, the angle of inclination of CD. (2)

[24]

QUESTION 3

3.1 Simplify without using a calculator

$$\frac{\cos 109^0 . \cos 330^0 . \tan 240^0}{\cos 19^0 . \tan 225^0 . \tan 161^0}$$

(6)

3.2 Simplify the following:

$$\frac{\cos(180^0 - k).\sin(360^0 - k).\tan(180^0 - k)}{sin^2(6^0 + k) + cos^2(6^0 + k)} - cos^2 k$$

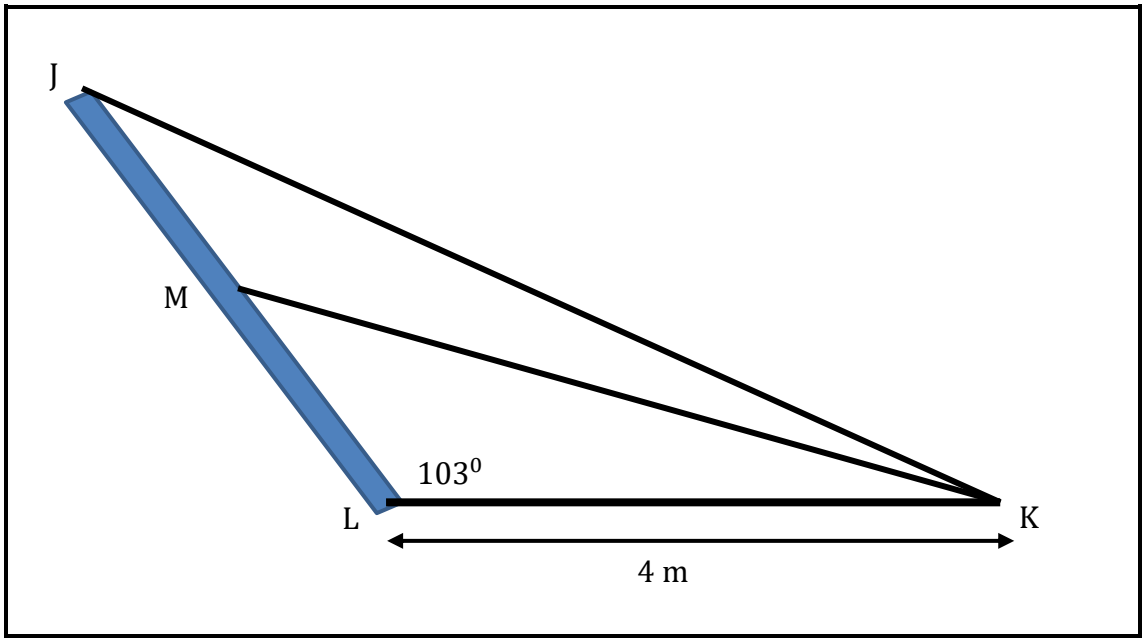
(6)

3.3 Solve for β, where $0^0 \leq \beta \leq 360^0$

$$6sin^2\beta + \cos\beta = 4$$

(6)

3.4 Civil engineering students attempt to pull a pole of length 12 metres to a vertical position using 2 cables from a point 4 metres away. The diagram below shows an instant when the angle between the pole and the horizontal was 103^0. A cable MK is attached halfway up the pole while cable JK is attached to the top.



3.4.1 Calculate the length of the cable MK. (3)

3.4.2 Calculate the angle $M\widehat{K}L$ between the cable MK and the horizontal. (3)

[24]

QUESTION 4

4.1 Explain the difference between the following terms as used in social clubs:

4.1.1 Budgeted income and actual income.

4.1.2 Affiliation fees and membership fees.

(2 × 2) (4)

4.2 Ebenezer is a social club for workers at a Hotel in Newcastle. During the year 2023:

- Each member contributed R100 subscription fees monthly.
- The employer donated R10 000

An incomplete income and expenses statement is given below, missing the values E, F, G, H, V, N, P, Q and T.

ITEM	BUDGETED AMOUNT	ACTUAL AMOUNT	VARIANCE
INCOME(Rands)			
Balance from previous year	20 000	20 000	0
Subscription fees	12 000	12 000	0
Donations	10 000	10 000	0
Sales	4 000	6 500	**E**
Interest from investments	3 000	**V**	215
Hosting Cooking Contest	5 000	6 000	1 000
TOTAL	**F**	**G**	**H**
EXPENSES (Rands)			
Purchase of Ingredients	2 000	2 500	−500
Stationery	400	350	50
Hosting Cooking Contest	1500	1 800	−300
Year-end Party	2 500	2 750	−250
TOTAL	**6 400**	**7 400**	**Q**
SURPLUS/DEFICIT	**N**	**P**	**T**

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.2.1–4.2.6) in the ANSWER BOOK.

4.2.1 The interest received from investments is … .

A R2 885
B R3 215
C R 215
D R3 000

4.2.2 The surplus/deficit value T is equal to … .

A $P - N$
B $N + P$
C $H - Q$
D $H + Q$

4.2.3 The total amount of money received by the club in the year 2023 is equal to … .

A R54 000
B R54 500
C R57 285
D 57 715

4.2.4 The value of E is … .

A R3 215
B R2 500
C −R2 500
D −R3 215

4.2.5 F is the amount … .

A the club planned to receive for the year.
B the club used during the year.
C the club received during the year.
D the club planned to spend during the year.

4.2.6 How much money was in the club's account at the end of the year?

A N
B R7 400
C P
D R6 400

(6 × 1) (6)

4.3 Marvy invests R60 000 at 14,5% per annum compounded quarterly for a period of 30 months. Calculate the value of her investment at the end of this period. (3)

4.4 Mr Colbert wants to travel overseas in six years' time. He invests R90 000 in a savings account in order to save up for the overseas trip. The interest rate for the investment is 11% per annum compounded annually. At the end of the fourth year he runs into financial difficulty and withdraws R14 000 from the account. Sensing he might not reach his required target; he reinvests the remaining amount into another savings account at an interest rate of 18% compounded semi-annually.

4.4.1 Draw a timeline for Mr Colbert's investments showing all deposits, withdrawals and interest rates. (3)

4.4.2 The cost of the trip is calculated to be R200 000 in 6 years' time. Will Mr Colbert afford to travel overseas?

Show all calculations. (5)

[21]

TOTAL: 100

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FORMULA SHEET

1. Slant surface area of a pyramid $= \frac{1}{2}aln$ or $= \frac{1}{2}a\,h_s n$ (where n =number of sides)
2. Surface area of triangular pyramid $= \frac{1}{2}bh + \frac{1}{2}pl$ where p =perimeter of the base.
3. Surface area of a pyramid with an equilateral triangle as base $= \frac{\sqrt{3}}{4}s^2 + \frac{1}{2}pl$.
4. Surface area of an equilateral triangular pyramid $= \sqrt{3}s^2$
5. Surface area of a square pyramid $= b^2 + \frac{1}{2}pl$
6. Surface area of regular hexagonal pyramid $= \frac{3\sqrt{3}}{2}b^2 + \frac{1}{2}pl$
7. Volume of a pyramid $= \frac{1}{3}$(area of base) $\times$ ⊥height.
8. $s = \frac{1}{2}(a + b + c)$ and $a, b\ and\ c$ are the sides of the triangle.
9. $A = \sqrt{s(s-a)(s-b)(s-c)}$
10. Circumference of a circle $= 2\pi r$
11. Area of curved surface of a cone $= \pi rl$ or $\pi r h_s$
12. Slant height of a cone $l = \sqrt{h^2 + r^2}$ or $= \sqrt{\perp h^2 + r^2}$
13. Volume of a cone $V = \frac{1}{3}\pi r^2 \times$⊥h
14. Area of a sphere $A = 4\pi r^2$
15. Volume of a sphere $V = \frac{4}{3}\pi r^3$
16. $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$
17. $(x_m; y_m) = \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$
18. $\theta = tan^{-1}m$
19. Distance $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
20. $\frac{sin\theta}{cos\theta} = tan\theta$

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21. $sin^2\theta + cos^2\theta = 1$

22. $\frac{sin\hat{A}}{a} = \frac{sin\hat{B}}{b} = \frac{sin\hat{C}}{c}$

23. $a^2 = b^2 + c^2 - 2bc\ cos\hat{A}$

24. $Area\ = \frac{1}{2}ab\ sin\hat{C}$

25. $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

26. $\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{n}$

27. $Q_{j\ position} = \frac{j}{4}(n+1)$

28. $Q_i = Q_3 - Q_1$

29. Upper Fence $= Q_3 + 1{,}5Q_i$

30. Lower Fence $= Q_1 - 1{,}5Q_i$

31. $Me = l + \frac{\left(\frac{n}{2} - F\right)}{f} \times c$

32. $Mo = l + \frac{f_m - f_{m-1}}{2f_m - f_{m-1} - f_{m+1}} \times c$

33. $I = A_0 \times \frac{r}{100} \times t \qquad or \qquad I = \frac{Prt}{100} \qquad A = P(1 + in)$

34. $A_t = A_0\left(1 + \frac{r}{100 \times m}\right)^{t \times m} \qquad or \qquad A = P(1+i)^n$

35. $A_t = A_0\left(1 - \frac{r}{100}\right)^n \qquad or \qquad A = P(1-i)^n$

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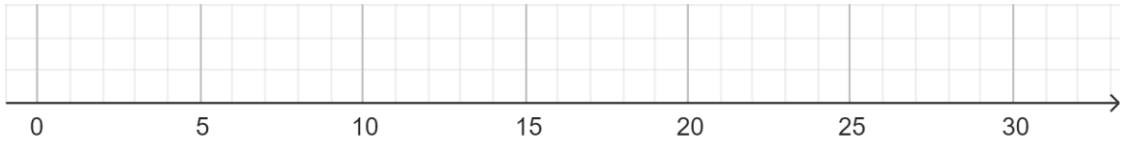
ANSWER SHEET 1

EXAMINATION NUMBER: | | | | | | | | | | | | | |

1.1.3



(5)

1.2.1

Number of hours x	Frequency f_i	Midpoint x_i	$f_i x_i$	< Cumulative Frequency
$0 \leq x < 20$	5	10	50	5
$20 \leq x < 40$	11	30	330	$\boldsymbol{d} =$
$40 \leq x < 60$	24	50	1200	40
$60 \leq x < 80$	8	70	560	48
$80 \leq x < 100$	$\boldsymbol{a} =$	90	$\boldsymbol{b} =$	50
TOTAL	$\sum f_i = 50$		$\sum F_i x_i$ $\boldsymbol{c} =$	

(4)

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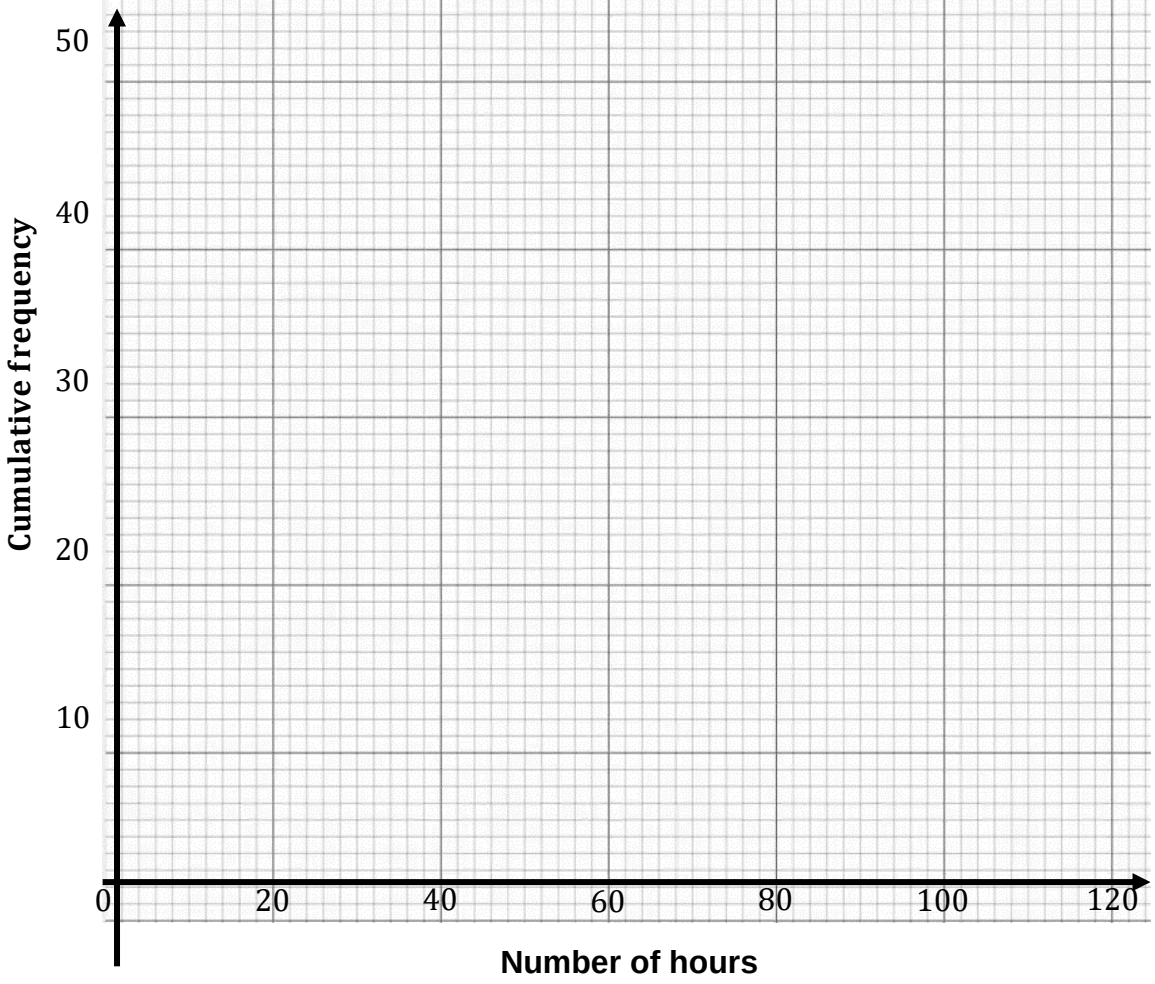
ANSWER SHEET 2

EXAMINATION NUMBER: | | | | | | | | | | | | |

1.2.3



(4)

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