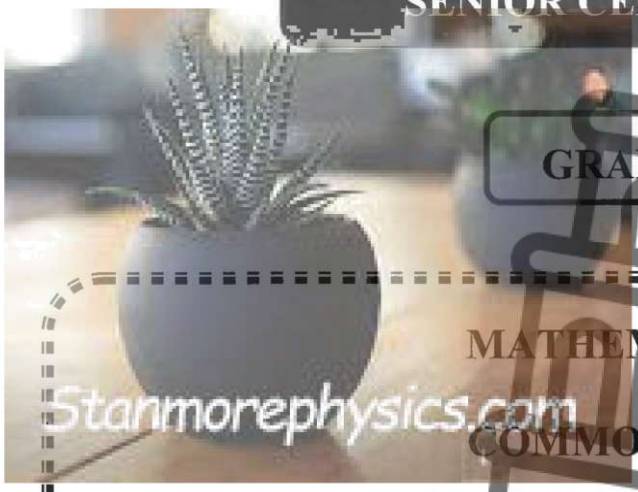
KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE



GRADE 11

MATHEMATICS

COMMON TEST

SEPTEMBER 2023

MARKS: 75

TIME: 1½ hours

This question paper consists of 7 pages and 2 DIAGRAM SHEETS.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 4 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
8. TWO DIAGRAM SHEETS FOR QUESTION 3.1.1, QUESTION 3.1.3 and QUESTION 4.2 are attached at the end of this QUESTION PAPER. Detach the DIAGRAM SHEETS and hand in together with your ANSWER BOOK.
9. Diagrams are NOT necessarily drawn to scale.
10. Write neatly and legibly.

QUESTION 1

1.1 Eduard bought a car for R150 000. The value of the car will depreciate at 8,4% per year. Calculate the book value of the car in 10 years' time if depreciation is calculated using the:

1.1.1 straight-line method. (2)

1.1.2 reducing balance method. (2)

1.2 Nozipho invested R10 000 for 3 years at an interest rate of x% p.a., compounded monthly. The total amount of interest earned over the 3 year period was R3282, 71.

1.2.1 What was the total amount in the account at the end of the 3 year period? (1)

1.2.2 Calculate the value of x, the interest rate. (5)

1.2.3 Calculate the effective interest rate of this investment. (3)

1.3 Pravin's grandmother gave him an amount of money as a gift. He opened a savings account and deposited the full amount into this account. The account paid interest at the rate of 9% p.a., compounded quarterly.
He withdrew R70 000 from the account one year after his initial deposit.
At the end of the next year, the balance in the account was R72 838,06.
Calculate how much money Pravin received from his grandmother. (6)

[19]

QUESTION 2

2.1 The daily maximum temperature (in °C) and wind speed (in km/h) for a city were recorded for a period of 1 year (365 days).
The data was summarised in the table below.

	Number of days the maximum temperature was < 25 °C	Number of days the maximum temperature was ≥ 25 °C
No. of days the wind speed was ≥ 15 km/h	139	105
No. of days the wind speed was < 15 km/h	87	34

Use the information in this table to answer the questions below.

2.1.1 Calculate the probability that the maximum temperature was ≥ 25 °C on a randomly selected day. (2)

2.1.2 Calculate the probability that the maximum temperature was ≥ 25 °C and the wind speed was ≥ 15 km/h on a randomly selected day. (2)

2.1.3 Are the daily maximum temperature and wind speed independent events? Motivate your answer by calculations. (4)

2.2 For two events A and B, it is given that:

- P(A) = 0,3
- P(A and B) = 0,2
- P(not B) = 0,25

where A and B are two different events.

2.2.1 Draw a Venn diagram to represent this information. (3)

2.2.2 Determine P(A or B). (2)

2.3 Sizwe has enrolled with a driving school that guarantees that he will pass the test to obtain his driver's licence.

The probability that he will pass the driving test on his first attempt is $\frac{2}{5}$.

If he fails on his first attempt, the probability that Sizwe will pass the test on any attempt in the future is $\frac{2}{3}$.

Calculate the probability that Sizwe will pass the test in:

2.3.1 two attempts (2)

2.3.2 three attempts (2)

2.3.3 four or more attempts (2)

[19]

QUESTION 3

3.1 The weight at birth of babies born in clinics and hospitals over a period of time in a certain district were recorded. The results are summarised in the table below:

Weight (w) of baby at birth in kg	Number of babies born (frequency)
$1,0 \leq w < 1,5$	12
$1,5 \leq w < 2,0$	19
$2,0 \leq w < 2,5$	222
$2,5 \leq w < 3,0$	714
$3,0 \leq w < 3,5$	1131
$3,5 \leq w < 4,0$	782
$4,0 \leq w < 4,5$	234
$4,5 \leq w < 5,0$	43

3.1.1 Complete the cumulative frequency column of the table on DIAGRAM SHEET 1. (2)

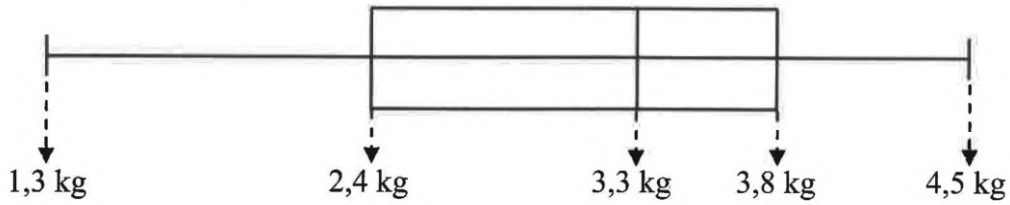
3.1.2 What is the total number of babies whose weights were recorded at birth during this period of time? (1)

3.1.3 Use the grid provided on DIAGRAM SHEET 1 to represent the above information in a cumulative frequency graph (ogive). (4)

3.1.4 Use the ogive to estimate the median weight of a baby at birth. (2)

3.1.5 Babies whose weight at birth was below 2,4 kg will have to stay in an incubator for a few days to receive extra support. What percentage of the babies in this group were required to stay in an incubator? (2)

3.2 On a certain day 20 babies were born in one of the hospitals. The weight at birth of these babies was summarised in the box and whisker diagram below.



Use the diagram to answer the questions below:

3.2.1 Calculate the interquartile range of the data. (2)

3.2.2 One of the doctors said that the mean weight of these babies was 3,5 kg. Could this possibly be correct? Clearly motivate your answer, using the box and whisker diagram. (3)

3.3 A group of Grade 11 learners wrote a test, of which the total mark was 50. The marks obtained by them are listed in the table below:

24	28	7	22	19	10
28	39	15	13	8	45

3.3.1 Determine:

(a) the mean of the marks obtained (2)

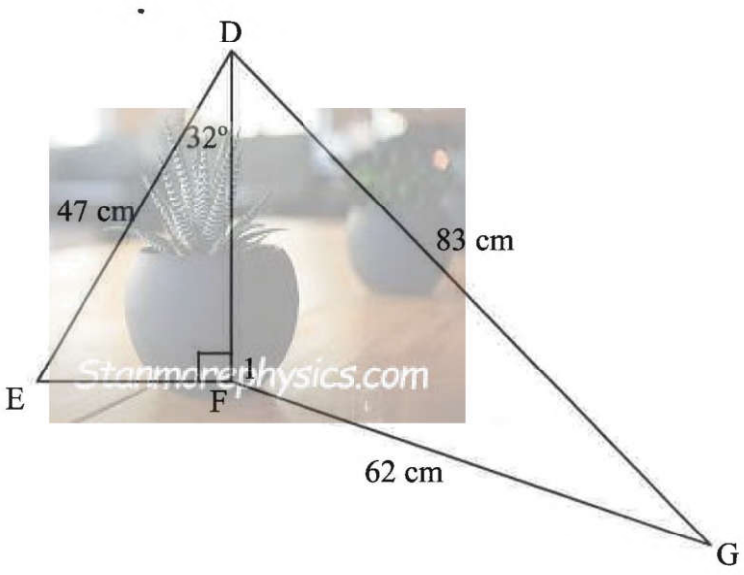
(b) the standard deviation of the data (1)

3.3.2 The same group of learners wrote another test that was also out of 50 marks. The standard deviation for this test was 6,8 and the mean mark was 21. How does the distribution of the marks in this test compare with the other test? Motivate your answer. (2)

[21]

QUESTION 4

4.1 D, E, F and G are points on level ground.
DE = 47 cm, FG = 62 cm, DG = 83 cm, $D\hat{F}E = 90^\circ$ and $E\hat{D}F = 32^\circ$.

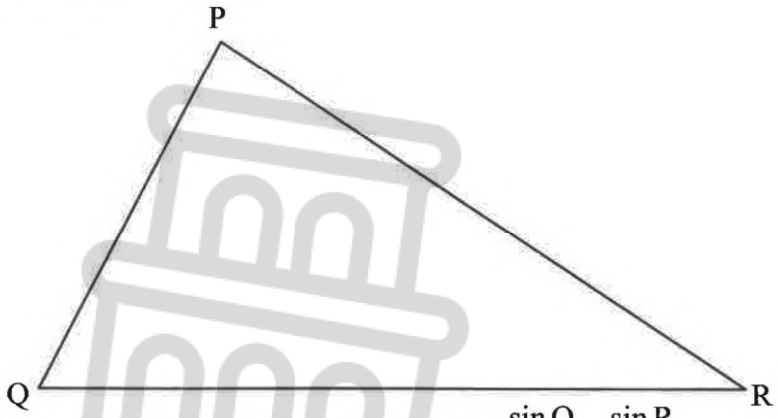


Calculate:

4.1.1 the length of DF (2)

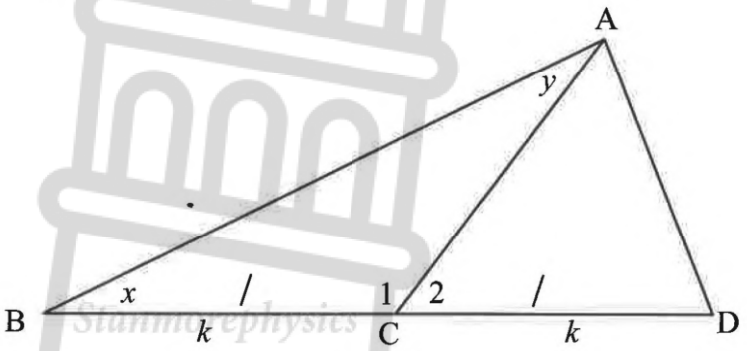
4.1.2 the size of $\hat{F}_1$ (4)

4.2 Given: Acute-angled ΔPQR.



Use the sketch provided on DIAGRAM SHEET 2 to prove that $\frac{\sin Q}{PR} = \frac{\sin R}{PQ}$. (5)

4.3 In the diagram, triangle ABD is drawn, with C a point on BD such that BC = CD = k. $\hat{B} = x$ and $B\hat{A}C = y$.



Show that the area of $\Delta ACD = \frac{k^2 \sin x.\sin(x+y)}{2\sin y}$. (5)

[16]

TOTAL: 75

NAME & SURNAME:

DIAGRAM SHEET 1

QUESTION 3.1.1

Weight (w) of babies at birth (in kg)	Number of babies (frequency)	Cumulative frequency
$1,0 \leq w < 1,5$	12	
$1,5 \leq w < 2,0$	19	
$2,0 \leq w < 2,5$	222	
$2,5 \leq w < 3,0$	714	
$3,0 \leq w < 3,5$	1131	
$3,5 \leq w < 4,0$	782	
$4,0 \leq w < 4,5$	234	
$4,5 \leq w < 5,0$	43	

QUESTION 3.1.3

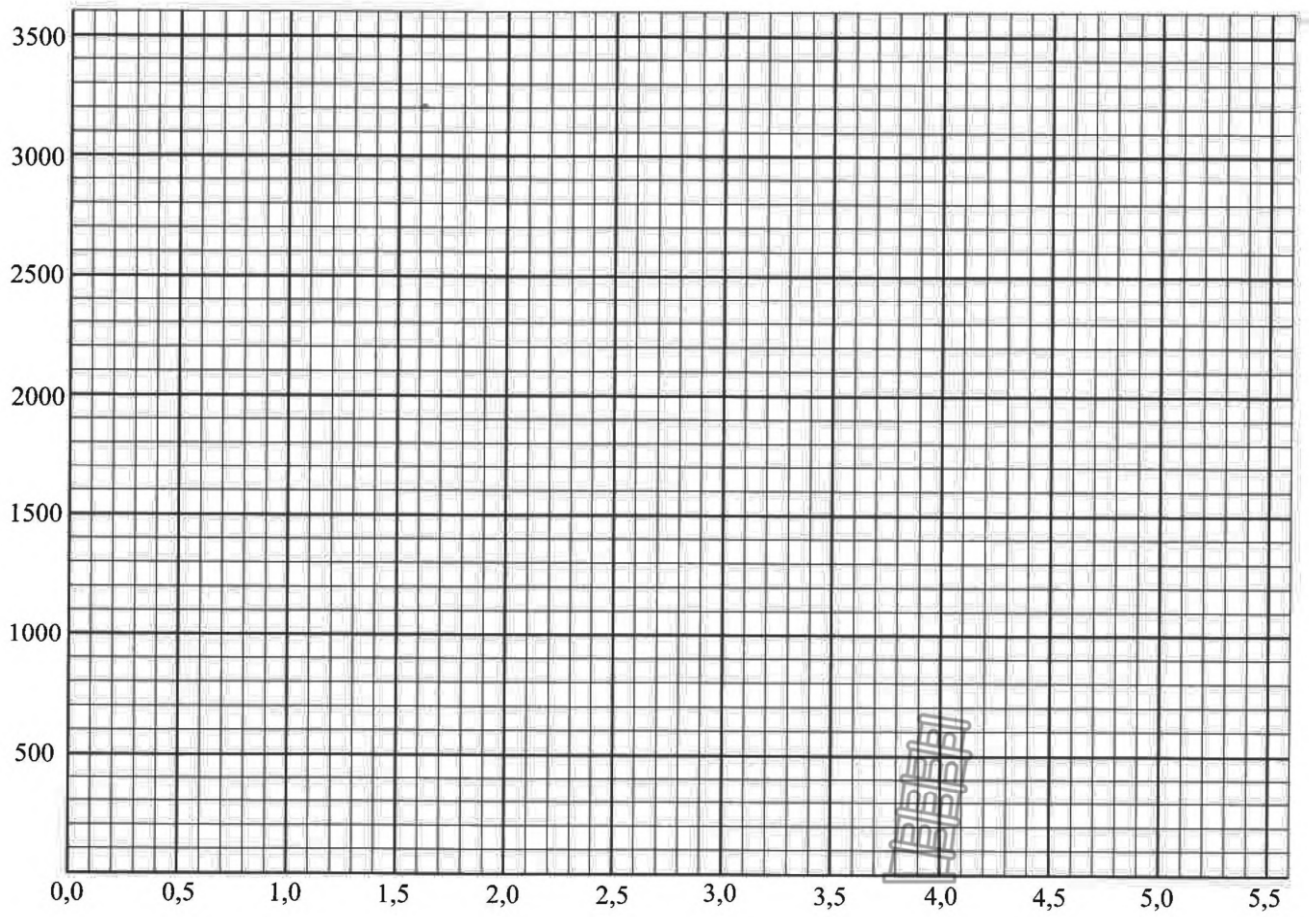


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DIAGRAM SHEET 2

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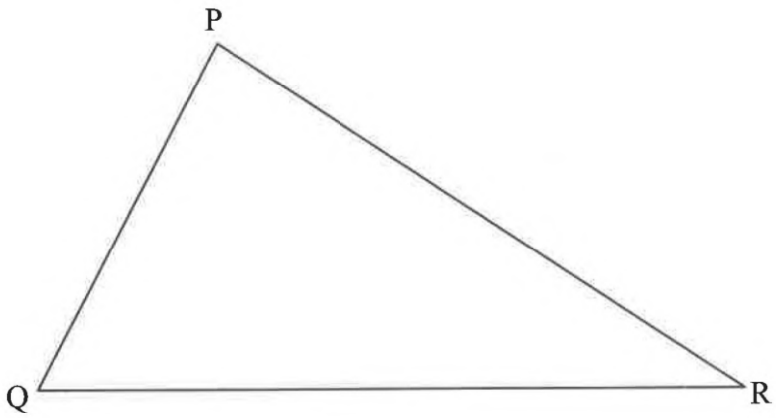
QUESTION 4.2



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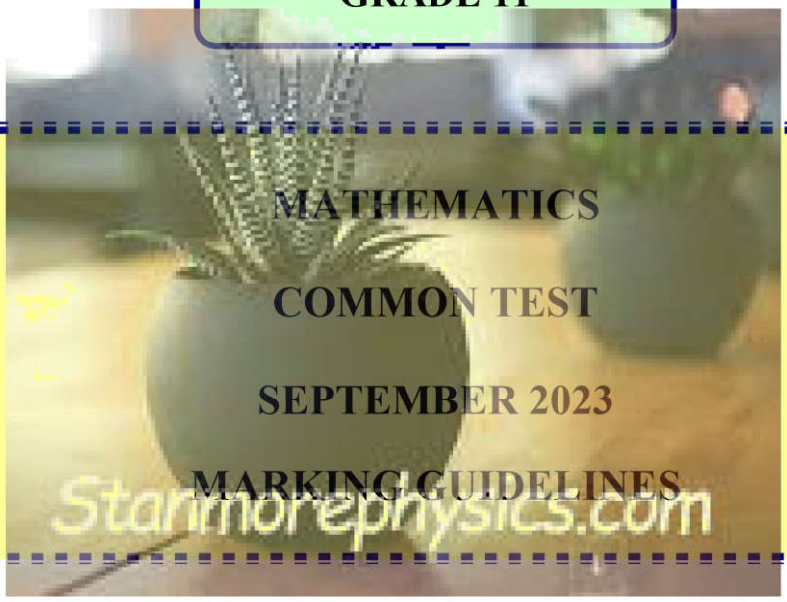


MATHEMATICS

COMMON TEST

SEPTEMBER 2023

MARKING GUIDELINES

MARKS: 75

This marking guidelines consist of 9 pages.

GRADE 11
Marking Guidelines

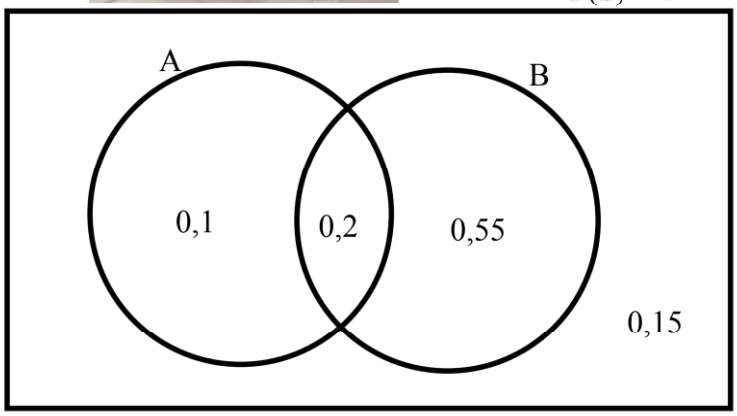
QUESTION 1

1.1.1	$A = P(1-in)$ $= 150\,000\left[1-0,084(10)\right]$ $= R24\,000$	✓ substitution into correct formula ✓ answer (2)
1.1.2	$A = P(1-i)^n$ $= 150\,000(1-0,084)^{10}$ $= R62\,380,09$	✓ substitution into correct formula ✓ answer (2)
1.2.1	R13 282,71	✓ answer (1)
1.2.2	$A = P\left(1+\frac{i}{12}\right)^{12n}$ $13\,282,71 = 10\,000\left(1+\frac{i}{12}\right)^{36}$ $\left(1+\frac{i}{12}\right)^{36} = \frac{13\,282,71}{10\,000}$ $1+\frac{i}{12} = \sqrt[36]{\frac{13\,282,71}{10\,000}}$ $\frac{i}{12} = \sqrt[36]{\frac{13\,282,71}{10\,000}} - 1$ $i = 0,095$ $\therefore x = 9,50$	✓ 36 ✓ substitution into correct formula ✓ taking 36th root ✓ isolating i ✓ answer (5)
1.2.3	$1+i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m$ $i_{eff} = \left(1+\frac{0,095}{12}\right)^{12} - 1$ $i_{eff} = 0,09924758...$ $r = 9,92\%$ **OR** $A = P(1+i_{eff})^n$ $13\,282,71 = 10\,000(1+i_{eff})^3$ $(1+i_{eff})^3 = \frac{13\,282,71}{10\,000}$ $i_{eff} = \sqrt[3]{\frac{13\,282,71}{10\,000}} - 1$ $i_{eff} = 0,09924769...$ $r = 9,92\%$	✓ formula ✓ substitution into correct formula ✓ answer (3) **OR** ✓ substitution into correct formula ✓ simplification ✓ answer (3)

1.3	$\left[P\left(1+\frac{0,09}{4}\right)^4-70\,000\right]\left(1+\frac{0,09}{4}\right)^4=72\,838,06$	✓ $P\left(1+\frac{0,09}{4}\right)^4$ ✓ subtracting 70 000 ✓ multiplying by $\left(1+\frac{0,09}{4}\right)^4$ ✓ equating LHS to R72 838,06
	$P=\frac{\frac{72\,838,06}{\left(1+\frac{0,09}{4}\right)^4}+70\,000}{\left(1+\frac{0,09}{4}\right)^4}$	✓ making P the subject
	$=\text{R}125\,000$	✓ answer (6)
	OR	**OR**
	P_1 — $A_1-\text{R}70\,000=P_2$ — $A_2=\text{R}72\,838,06$	
	$A_2=P_2(1+i)^n$	
	$72\,838,06=P_2\left(1+\frac{0,09}{4}\right)^4$	✓ equating RHS to 72 838,06 ✓ correct substitution
	$P_2=\frac{72\,838,06}{\left(1+\frac{0,09}{4}\right)^4}$ $A_1=P_2+70\,000$ $A_1=P_1(1+i)^n$	✓ simplification ✓ adding R70 000
	$A_1=P_1\left(1+\frac{0,09}{4}\right)^4$	✓ substitution
	$P_1=\frac{A_1}{\left(1+\frac{0,09}{4}\right)^4}$ $=\text{R}125\,000$	✓ answer (6)
		[19]

GRADE 11
Marking Guidelines

QUESTION 2

2.1.1	$P(\text{temperature} \geq 25\ ^\circ\text{C}) = \frac{139}{365}$ $= 0,38$ OR $38,08\%$	✓ 139 ✓ answer ($\frac{139}{365}$ or 0,38 or 38,08%) (2)
2.1.2	$P(\text{temperature} \geq 25\ ^\circ\text{C and wind speed} \geq 15\ \text{km/h}) = \frac{105}{365}$ $= 0,29$ OR $28,77\%$	✓ 105 ✓ answer ($\frac{105}{365}$ or 0,29 or 28,77%) (2)
2.1.3	$P(\text{wind speed} \geq 15\ \text{km/h}) = \frac{244}{365}$ $= 0,67$ $P(\text{temperature} \geq 25\ ^\circ\text{C}) \times P(\text{wind speed} \geq 15\ \text{km/h})$ $= 0,38 \times 0,67$ $= 0,25$ $\therefore P(\text{temperature} \geq 25\ ^\circ\text{C and wind speed} \geq 15\ \text{km/h}) \neq P(\text{temperature} \geq 25\ ^\circ\text{C}) \times P(\text{wind speed} \geq 15\ \text{km/h})$ $\therefore$ the temperature on a specific day and the wind speed on the same day are **not independent events**.	✓ $P(\text{wind speed} \geq 15\ \text{km/h}) = \frac{244}{365}$ or 0,67 ✓ $P(\text{temperature} \geq 25\ ^\circ\text{C}) \times P(\text{wind speed} \geq 15\ \text{km/h}) = 0,25$ ✓ not equal ✓ concluding (4)
2.2.1	P(S) = 1  	✓ 0,2 and 0,1 ✓ 0,55 ✓ 0,15 (3)
2.2.2	P(A or B) = 0,1 + 0,2 + 0,55 = 0,85 **OR** P(A or B) = P(A) + P(B) – P(A and B) = 0,3 + 0,75 – 0,2 = 0,85	✓ 0,1 + 0,2 + 0,55 ✓ answer (2) **OR** ✓ 0,3 + 0,75 – 0,2 ✓ answer (2)

GRADE 11
Marking Guidelines

2.3.1	P(passing on 2nd attempt) $= \text{P(failing on 1st attempt)} \times \text{P(passing on 2nd attempt)}$ $= \frac{3}{5} \times \frac{2}{3}$ $= \frac{6}{15} = \frac{2}{5} = 0,40$	✓ $\frac{3}{5} \times \frac{2}{3}$ ✓ answer $(\frac{6}{15}$ or $\frac{2}{5}$ or $0,40)$ (2)
2.3.2	P(passing on 3rd attempt) $= \text{P(failing on 1st)} \times \text{P(failing on 2nd)} \times \text{P(passing on 3rd)}$ $= \frac{3}{5} \times \frac{1}{3} \times \frac{2}{3}$ $= \frac{2}{15} = 0,13$	✓ $\frac{3}{5} \times \frac{1}{3} \times \frac{2}{3}$ ✓ answer $(\frac{2}{15}$ or $0,13)$ (2)
2.3.3	P(passing on 4th or more attempt) $= 1 - \text{P(passing on 1st, 2nd or 3rd attempt)}$ $= 1 - \left(\frac{2}{5} + \frac{2}{5} + \frac{2}{15}\right)$ $= \frac{1}{15}$ or $0,07$	✓ $1 - \text{P(passing on 1st, 2nd or 3rd attempt)}$ ✓ answer $(\frac{1}{15}$ or $0,07)$ (2)
		[19]

GRADE 11
Marking Guidelines

QUESTION 3

3.1.1

Weight (w) of baby at birth in kg	Number of babies born (frequency)	Cumulative frequency
$1,0 \le w < 1,5$	12	**12**
$1,5 \le w < 2,0$	19	**31**
$2,0 \le w < 2,5$	222	**253**
$2,5 \le w < 3,0$	714	**967**
$3,0 \le w < 3,5$	1131	**2098**
$3,5 \le w < 4,0$	782	**2880**
$4,0 \le w < 4,5$	234	**3114**
$4,5 \le w < 5,0$	43	**3157**

one mark out of 2: if one mistake has been made

two marks: if all values are correct

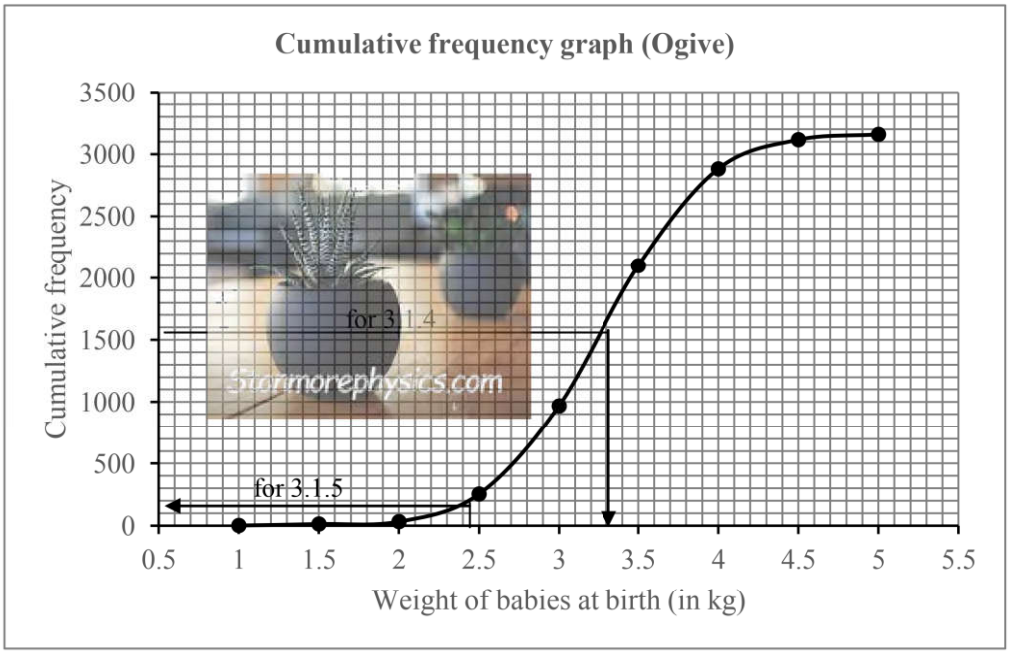
(2)

3.1.2 3157

✓ answer

(1)

3.1.3



✓ ogive grounded at (1 ; 0)

✓ points plotted correctly at upper limit

✓ cumulative frequency

✓ points joined using a curve

(4)

3.1.4 birth weight associated with a cumulative frequency of $\frac{3157}{2} \approx 1579$.

Median $\approx$ 3,27 kg (accept 3,2 to 3,4 kg)

✓ using cumulative frequency of $\frac{3157}{2} \approx 1579$

✓ answer

(2)

3.1.5 Cumulative frequency associated with birth weight of 2,4 kg = 180 babies (accept 160 to 200)

% of babies $\frac{180}{3157} \approx 5,70\%$ (accept 5,70% to 6,347%)

✓ number of babies

✓ answer

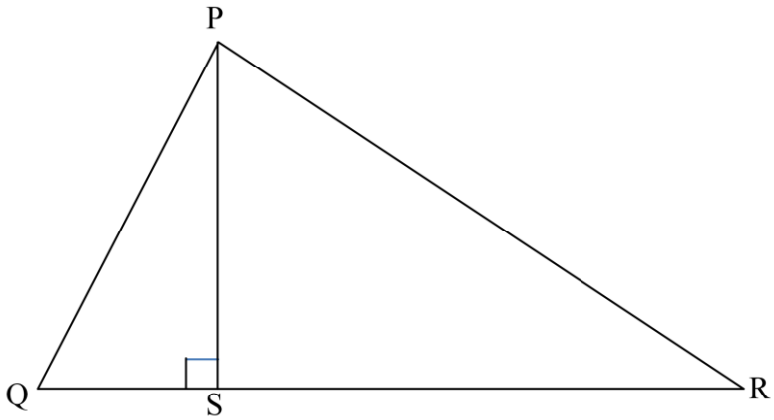
(2)

GRADE 11
Marking Guidelines

3.2.1	3,8 kg – 2,4 kg = 1,4 kg	✓ 3,8– 2,4 ✓answer (2)
3.2.2	No, this cannot be correct. The data is skewed to the left. Therefore the mean is smaller than the median, and cannot have a value of 3,5, which is bigger than 3,3.	✓ No, cannot be correct ✓ data skewed to the left ✓ mean < median (3)
3.3.1 (a)	$\bar{x} = \frac{258}{12}$ $= 21,5$	✓ $\frac{258}{12}$ ✓answer (2)
3.3.1 (b)	$\sigma = 11,53$	✓ answer (1)
3.3.2	The marks from this test were more closely grouped around the mean. The standard deviation for this test is smaller.	✓ closely grouped around the mean ✓ smaller standard deviation (2)
		[21]

GRADE 11
Marking Guidelines

QUESTION 4

4.1.1	$\frac{DF}{DE} = \cos D\hat{E}F$ $\frac{DF}{47^\circ} = \cos 32^\circ$ $\therefore DF = 47\cos 32^\circ$ $= 39,86$ cm	✓ $\frac{DF}{47^\circ} = \cos 32^\circ$ ✓ answer (2)
4.1.2	$DG^2 = DF^2 + FG^2 - 2.DF.FG.\cos \hat{F}_1$ $83^2 = 39,86^2 + 62^2 - 2(39,86)(62)\cos \hat{F}_1$ $\cos \hat{F}_1 = \frac{39,86^2 + 62^2 - 83^2}{2(39,86)(62)}$ $\cos \hat{F}_1 = -0,2946...$ $\hat{F}_1 = 107,13^\circ$	✓ applying cosine rule in ΔDFG ✓ substitution ✓ $\cos \hat{F}_1$ subject of formula ✓ answer (4)
4.2	 Construction: Draw PS, with S on QR, such that PS ⊥ QR. Proof: $\frac{PS}{PQ} = \sin \hat{Q}$ $\therefore PS = PQ\sin \hat{Q}$ …….. line 1 $\frac{PS}{PR} = \sin \hat{R}$ $\therefore PS = PR\sin \hat{R}$ …….. line 2 From line 1 and line 2: $PQ\sin \hat{Q} = PR\sin \hat{R}$ $\therefore \frac{\sin Q}{PR} = \frac{\sin R}{PQ}$	✓ construction ✓ $\frac{PS}{PQ} = \sin \hat{Q}$ ✓ $PS = PQ\sin \hat{Q}$ ✓ $\frac{PS}{PR} = \sin \hat{R}$ ✓ $PQ\sin \hat{Q} = PR\sin \hat{R}$ (5)

4.3	In ΔABC: $\frac{AC}{\sin \hat{B}} = \frac{BC}{\sin B\hat{A}C}$ $\frac{AC}{\sin x} = \frac{k}{\sin y}$ $AC = \frac{k \sin x}{\sin y}$ $\hat{C}_2 = x + y$ [ext. $\angle$ of ΔABC] Area of $\Delta ACD = \frac{1}{2} AC.CD.\sin \hat{C}_2$ $= \frac{1}{2}\left(\frac{k \sin x}{\sin y}\right).k.\sin(x+y)$ $= \frac{k^2 \sin x.\sin(x+y)}{2 \sin y}$	✓ $\frac{AC}{\sin \hat{B}} = \frac{BC}{\sin B\hat{A}C}$ ✓ $AC = \frac{k \sin x}{\sin y}$ ✓ $\hat{C}_2 = x + y$ ✓ Area $\Delta ACD = \frac{1}{2} AC.CD.\sin \hat{C}_2$ ✓ substitution (5)
		[16]

TOTAL: 75