MEREWETHER HIGH SCHOOL

Name:_____

2023 Trial HIGHER SCHOOL CERTIFICATE EXAMINATION

Year 12 Mathematics Standard 2

Assessment Task 4

2023

General Instructions

- Reading time – 10 minutes
- Working Time – 2 hours and 30mins
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total Marks: 100

Section I – 15 marks (pages 2 - 9)

- Attempt Questions 1 - 15
- Allow about 25 minutes for this section

Section II – 85 marks (pages 10 - 31)

- Attempt Questions 16 - 40
- Allow about 2 hours and 5 minutes for this section

Section I

15 marks

Attempt Questions 1 – 15

Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1 - 15.

---

1 What is the value of $\sqrt{\frac{\pi^3}{2}}$ correct to 2 decimal places?

A. 2.77

B. 2.78

C. 3.93

D. 3.94

2 Which of the following measurements is the same as 1.5 km^2?

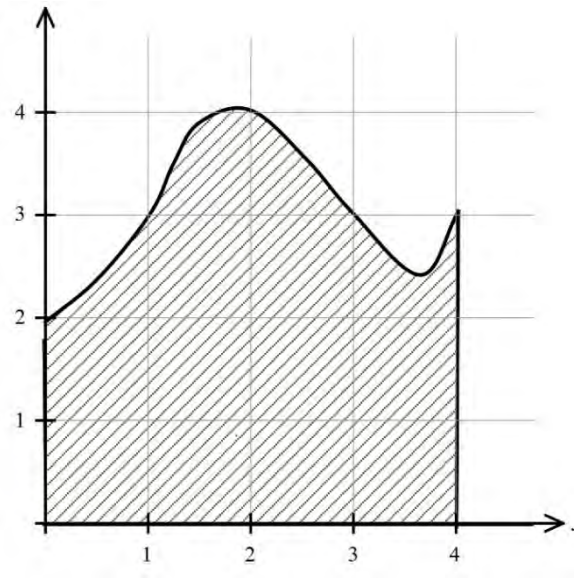
A. 1.5 km × 1.5 km

B. 1.5 × 10^6 m^2

C. 1.5 × 10^9 cm^2

D. 1.5 × 10^{11} mm^2

3 Using two applications of the Trapezoidal rule, find an estimate for the area of the irregular shape shown below. (Each square on the grid is one square unit.)



A. 13.0 square units

B. 14.0 square units

C. 15.0 square units

D. 16.0 square units

4 A company pays employees a weekly retainer of $200 plus 12% commission on sales over $3500. Calculate Charlie's fortnightly pay if his sales are $8000 over the past fortnight.

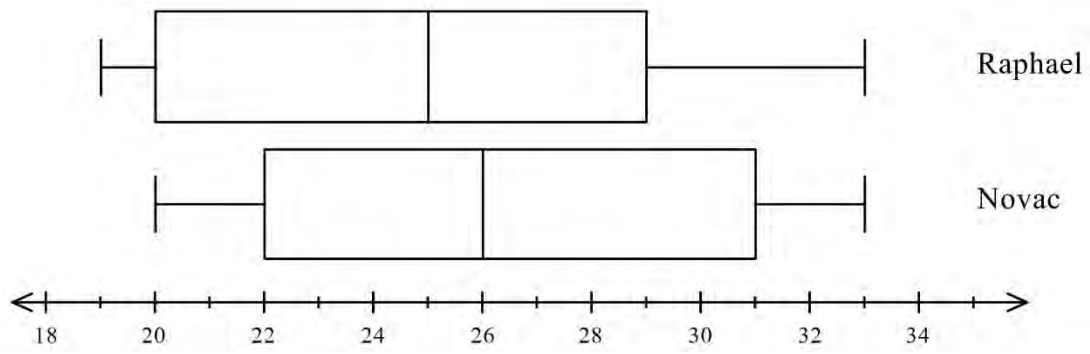
A. $740

B. $940

C. $1060

D. $1360

5 The parallel box plots below are used to compare the time taken to complete a set of tennis (to the nearest minute), by two players over their last 40 games.



Which is NOT true statement about the two sets of data?

A. They have the same interquartile range.

B. Novac has a higher median.

C. Raphael had the fastest set.

D. They both have the same upper quartile.

6 After 6 years of use a washing machine has depreciated to the value of $8000, using the declining balance method of depreciation. If the annual rate of depreciation was 12.5%, how much was the machine worth when purchased new?

A. $12 000

B. $17 826

C. $18 348

D. $19 235

7 On a business trip, Frankie plans to travel 1500 km on highways and 350 km in city traffic.

His car has estimated fuel consumption rates of 7.34 L/100 km on highways and 10.46 L/100 km in city traffic.

Calculate the amount of fuel he could expect to use on the trip.

A. 146.7 L

B. 164.7 L

C. 237.8 L

D. 329.3 L

8 This set of data is arranged in order from smallest to largest.

5, 6, 11, x, 13, 18, 25

The range is six less than twice the value of x. Which one of the following is true?

A. The median is 12 and the interquartile range is 7.

B. The median is 12 and the interquartile range is 12.

C. The median is 13 and the interquartile range is 7.

D. The median is 13 and the interquartile range is 12.

9 Which of the following graphs has the largest positive correlation coefficient value?

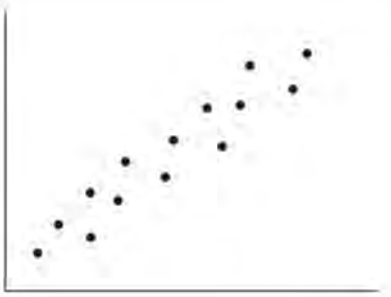
A.



B.



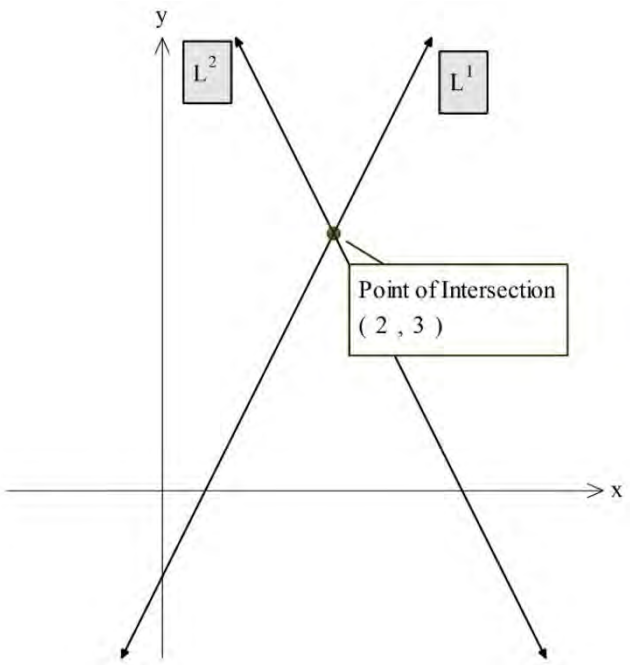
C.



D.



10 When two lines L^1 and L^2 are graphed, the simultaneous solution to the equations is shown on the graph below:



Which pair of equations could identify the two lines?

A. $y = 2x - 1 \; and \; y = -2x + 7$

B. $y = -2x + 5 \; and \; y = x + 1$

C. $y = x^2 - 2 \; and \; y = -4x + 9$

D. $y = \frac{2}{x} + 3 \; and \; y = -2x + 7$

11 Sophia is planning to take a holiday 6 months from now, and there are four options that she is considering.

Holiday	*Estimated Cost*
Kakadu Adventure	$3000
NZ Ski Trip	$6000
European Summer	$9000
Everest Base Camp	$12 000

She earns $75 000 per annum after tax and other deductions. With her weekly spending at $900 per week and bills costing her $1300 per month, she is able to save the rest for her holiday. What is the most expensive holiday she can afford?

A. Kakadu Adventure

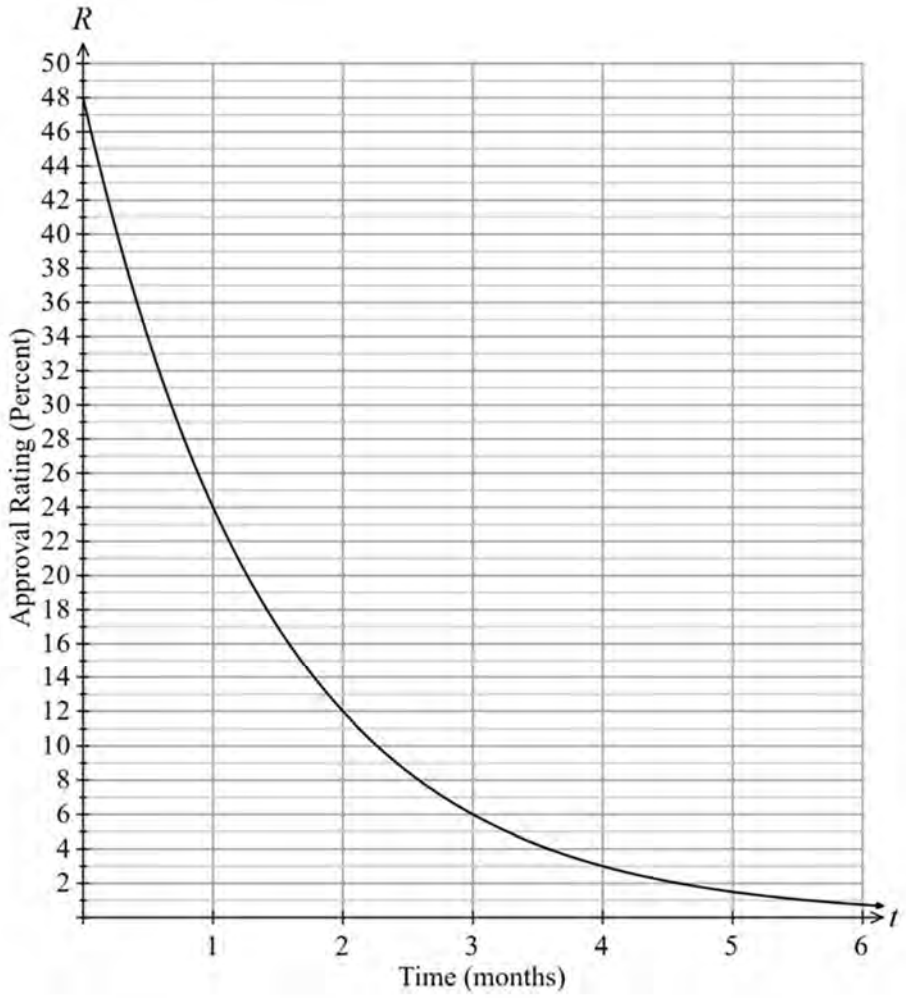
B. NZ Ski Trip

C. European Summer

D. Everest Base Camp

12 The approval rating of a politician falls dramatically after an election. The rate of decrease can be modelled by the equation: $R = a \times b^{-t}$, where R is the percentage approval rating, t is the time in months since the election and a and b are positive constants.

The graph below shows the relationship.



Which equation could be used to model the graph shown?

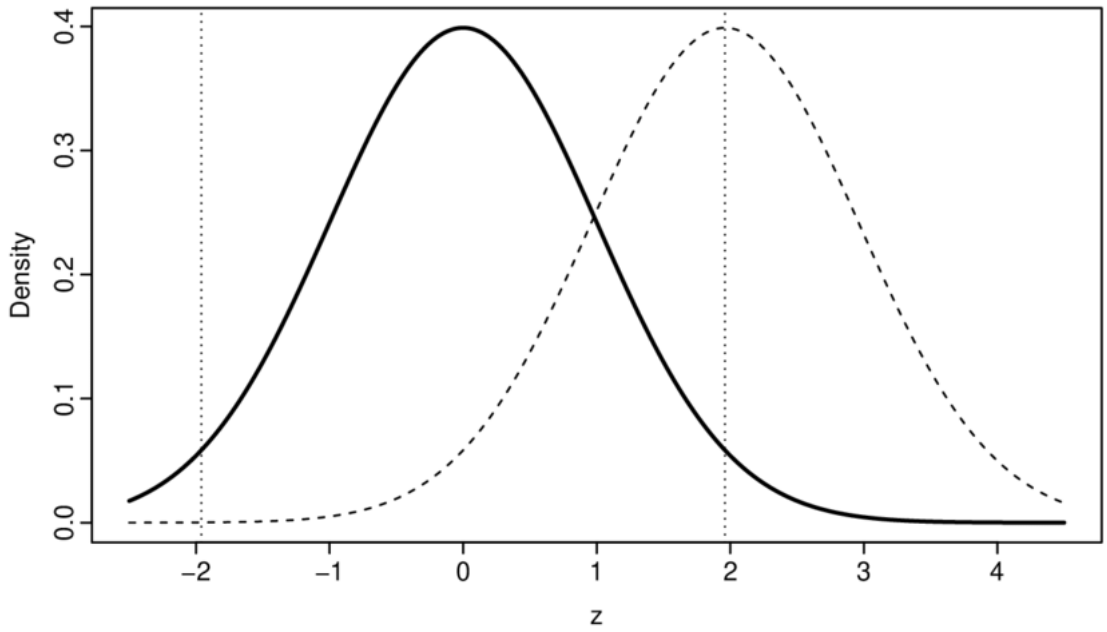
A. $R = 2 \times 48^{-t}$

B. $R = 24 \times 2^{-t}$

C. $R = 48 \times 2^{-t}$

D. $R = 48 \times 4^{-t}$

13 The following image depicts the normal distribution charts for two different groups.



Which of the following statements would best describe the data?

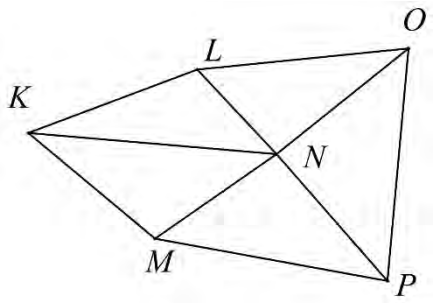
A. Both groups had the same mean but a different standard deviation.

B. Both groups had the same mean and same standard deviation.

C. Both groups had different means but the same standard deviation.

D. Both groups had different means and a different standard deviation.

14 A network diagram is shown below



How many unique paths are possible from *K* to *P*?

A. 4

B. 8

C. 12

D. 16

15 The speeds (in km/h) which are recorded on a radar device approaching a section of roadwork are normally distributed, with a mean of 58 and a standard deviation of 4.

The speed limit for the section is 60 km/h and 2400 vehicles passed the radar in one day.

How many vehicles were travelling at 2 km/h above the speed limit or more?

A. 60 vehicles

B. 384 vehicles

C. 768 vehicles

D. 1632 vehicles

2023 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION (Assessment Task 4)

Year 12 Mathematics Standard 2

Section II Answer Booklet

85 marks

Attempt Questions 16 – 40

Allow about 2 hours and 5 minutes for this section

Instructions:

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.
- **Extra writing space is provided at the back of this booklet**. If you use this space, *note with the question you have used the extra writing space* **and** clearly indicate which question you are answering in the extra writing space.

Question 16 (2 marks)

A formula relating *A* and *t* is: $A = \frac{24}{\sqrt{t+1}}$.

a) Rewrite the formula with *t* as the subject. **2**

……

……

……

……

……

……

Question 17 (3 marks)

Two teams entered a 3-point shooting contest. The points were recorded for each participant and the results are displayed in the back-to-back stem-and-leaf plot below:

Team A					Team B			
	8	6	5	0	6			
6	5	5	4	1	3	7	9	9
9	7	2	0	2	3	5	5	8
		3	1	3	4	6	7	

a) What was the difference between the two teams median scores? **1**

…….

…….

b) Team B has a standard deviation of 9.00, calculate the standard deviation for Team A and explain what this means in terms of statistical comparison. **2**

…….

…….

…….

…….

Question 18 (2 marks)

a) A graduate has a starting gross salary of $75 000 per annum. The person is offered a 2.5% annual increase as part of their employment contract. Calculate the gross salary the person will receive at the end of their 5^{th} year of employment. **1**

……..

……..

……..

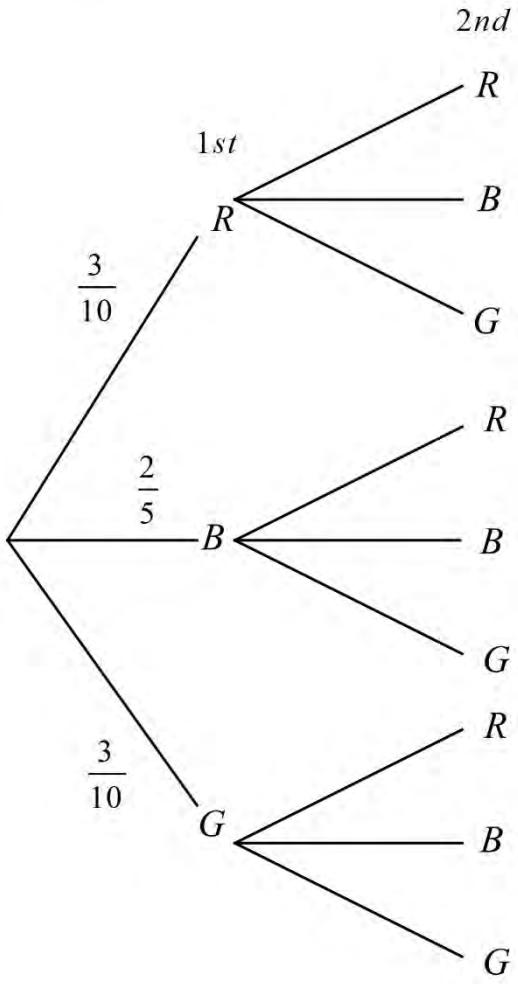
b) What will be the percentage increase overall from their starting gross salary to the salary in 5 years' time, to one decimal place? **1**

……..

……..

Question 19 (3 marks)

A bag contains 3 red, 4 blue and 3 green marbles. Two marbles are selected from the bag without replacement.



a) Complete the probability tree for the second stage branches. **1**

b) Calculate the probability of selecting marbles of the same colour. **2**

……..

……..

……..

……..

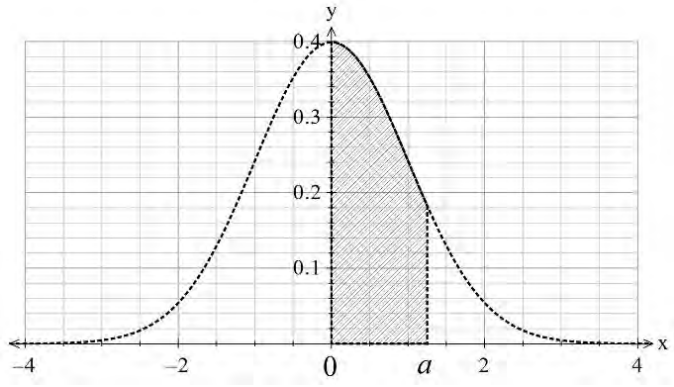
……..

……..

……..

Question 20 (3 marks)

The table below shows the percentage of scores which lie between $z = 0$ and $z = a$, where a is a positive value, for a normal distribution. The table can also be used for scores to the left of $z = 0$, as the distribution is symmetrical.



z-score	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
%	0.00	3.98	7.93	11.79	15.54	19.15	22.57	25.80	28.81	31.59

a) A particular normal distribution has a mean of 30 and a standard deviation of 5. Convert a score of 33.5 from this distribution to a z-score. **1**

……..

……..

……..

……..

b) Calculate the percentage of scores in the distribution that will lie between 28 and 33.5. **2**

……..

……..

……..

……..

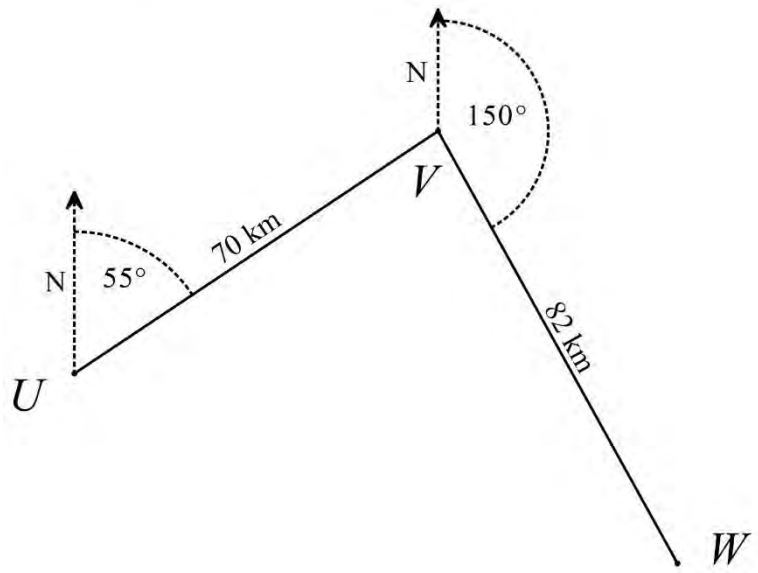
……..

Question 21 (4 marks)

A helicopter leaves Underwood and flies 70 km on a bearing of 055° to Vanna Beach.

It then flies 82 km on a bearing of 150° to Weston.

The diagram below illustrates the journey.



a) It plans to fly directly back to Underwood. Calculate the distance, to the nearest km, that it will fly. **2**

……..

……..

……..

……..

……..

……..

b) Determine the bearing, to the nearest degree, on which it should fly from Weston to return to Underwood. **2**

……..

……..

……..

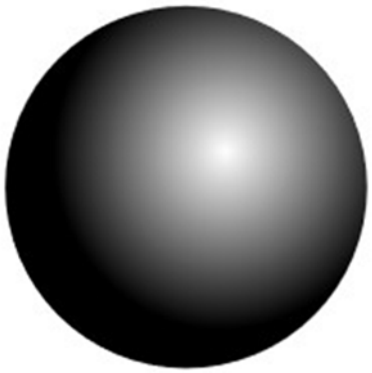
……..

……..

……..

Question 22 (3 marks)

A cannon ball is made out of steel and has a diameter of 17cm.



a) Find the volume of the sphere in cubic metres. **2**

……..

……..

……..

……..

b) It is known that the mass of the steel used is $7.85\ tonnes/m^3$. Find the mass of the ball to the nearest gram. **1**

……..

……..

……..

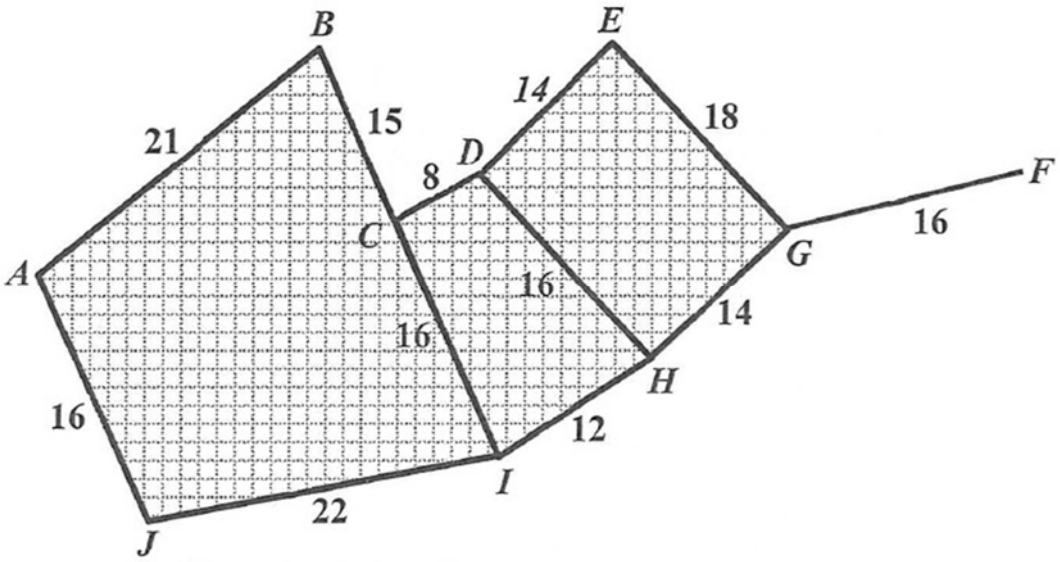
……..

……..

……..

Question 23 (3 marks)

Cables are to connect the 10 junction points ($A - J$) in a warehouse, shown in the diagram, where the distances between the junctions are in metres.



a) Draw a minimum spanning tree below and determine the length of cable required to join all the junction points in the most efficient manner. **2**

Length of cable = _____

b) A further 5 junction points are added to a new design layout for the warehouse. State the number of edges that would form spanning tree on this new network diagram. **1**

……..

……..

Question 24 (4 marks)

A cube is measured to have a side length of 18cm, using a ruler that has markings every 10mm.

a) The cube is to be painted on the outside surface everywhere, except for the bottom face. Given that 1L of paint will cover 12 m^2, how many cubes can be painted in this way with 5L of paint? **2**

……..
……..
……..
……..
……..
……..

b) Find the upper and lower bounds for the area, to one decimal place, of one face of the cube, taking into account the measurement error. **2**

……..
……..
……..
……..
……..
……..

Question 25 (2 marks)

Sam is currently living in Sydney and wants to stream the Wallabies Rugby World Cup game which is being played in France on Saturday the 9th September at 18:00.

France is located at UTC +1 and Sydney is UTC +10.

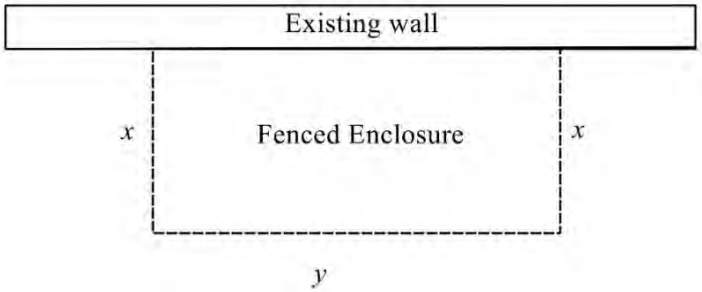
France is subject to daylight savings time, but Sydney is not.

At what time and date in Sydney should Sam begin streaming the match? **2**

……..
……..
……..
……..

Question 26 (4 marks)

Blair plans to build a fence against an existing wall to enclose a new area for her vegetable garden, as seen in the diagram below, using the 20 metres of wire fencing she has already purchased.



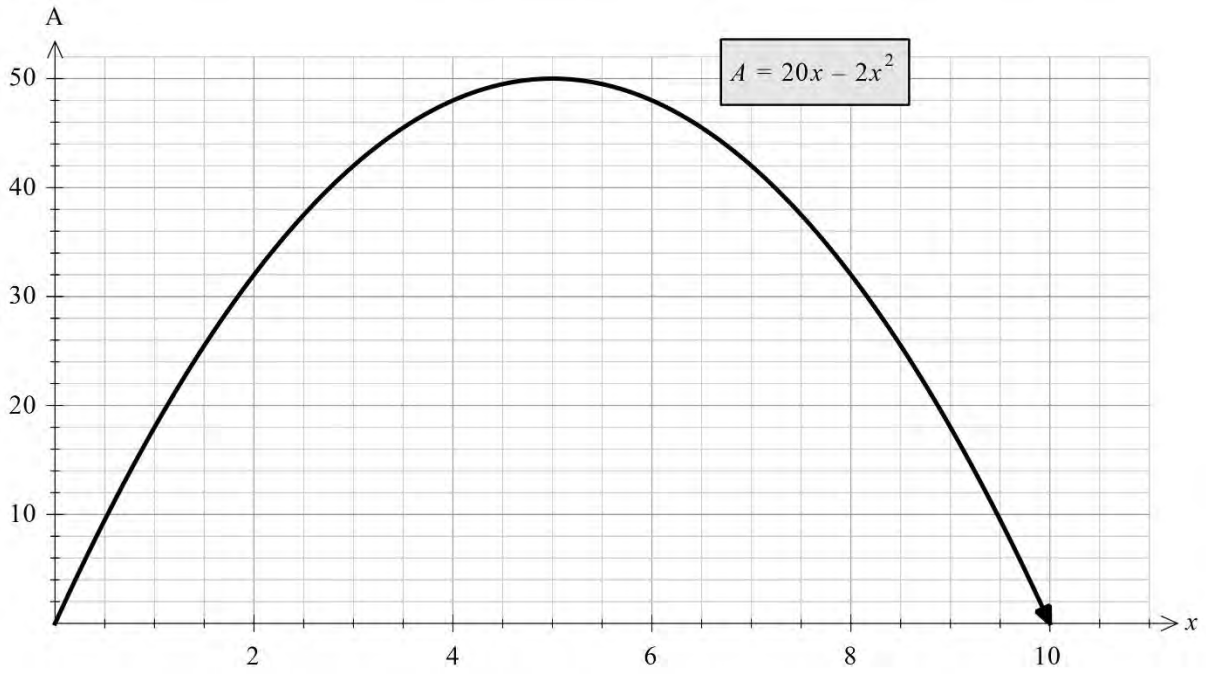
a) Write y in terms of x. Hence show that the area can be expressed as $A = 20x - 2x^2$. **1**

……..

……..

……..

b) The graph of $A = 20x - 2x^2$ is shown below.



Use the graph to determine the value(s) of x that would give the enclosure an area of $32m^2$ and give the dimensions of the enclosure in each case. **2**

……..

……..

……..

Question 24 continues on page 19

c) Determine the dimensions that will achieve the maximum possible area for the garden bed. **1**

……..
……..
……..

Question 27 (5 marks)

Marnus wishes to invest $4000 over a period of 5 years.

He has researched investment accounts and needs to make a decision between the two final choices.

ACA bank pays compound interest of 4.9% p.a. compounded annually.

BMG bank pays compound interest of 4.7% p.a. compounded monthly.

a) How much extra will he earn over the 5 years by choosing the better option? **3**

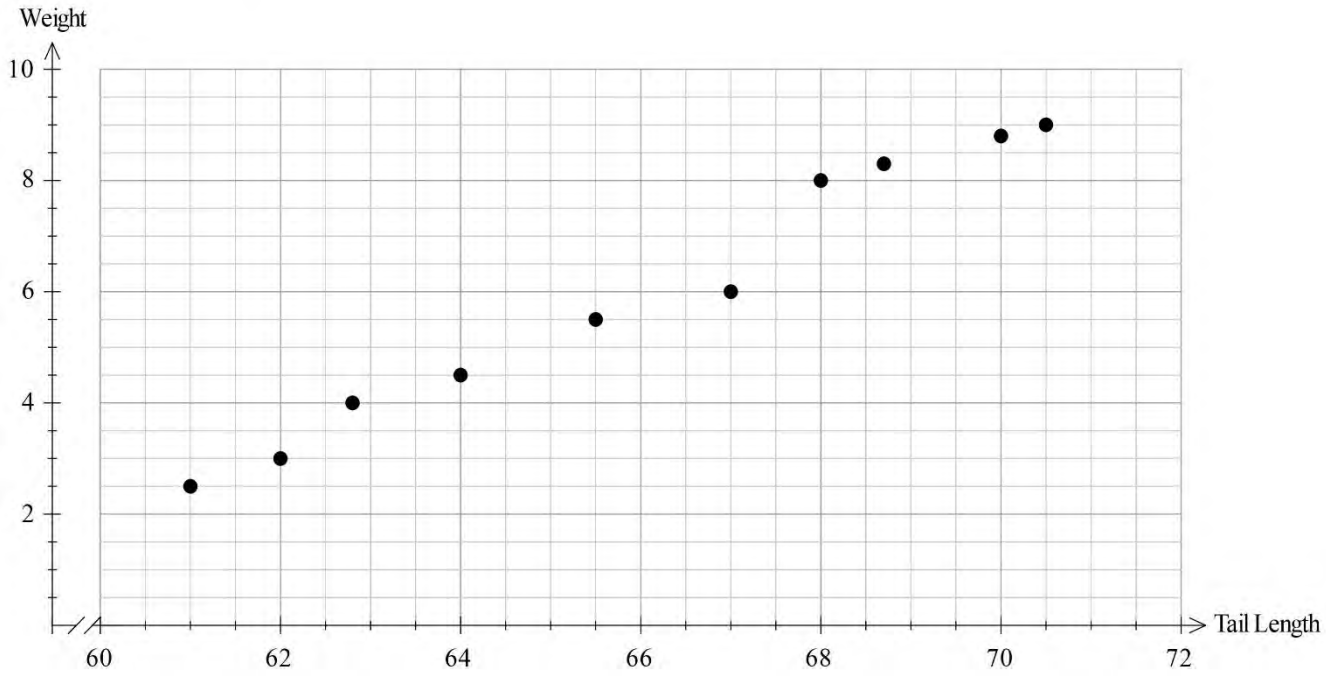
……..
……..
……..
……..
……..
……..
……..
……..

b) Find the interest rate percentage, correct to 3 decimal places, that will see Marnus's investment grow to $6000 over the 5 years if compounding annually. **2**

……..
……..
……..
……..
……..
……..

Question 28 (5 marks)

The tail lengths (cm) and weights (kg) of 10 animals of the same species are measured and recorded in the scatterplot below.



a) Describe the strength and correlation of the two variables. **1**

……..

……..

……..

b) Using the graph provided, apply a line of best fit and use the line to state the tail length of an animal weighing 5kg? **2**

……..

……..

……..

c) Explain why this model could not be used to predict the weights of animals whose tail length is 40cms. **2**

……..

……..

……..

……..

……..

……..

Question 29 (3 marks) **3**

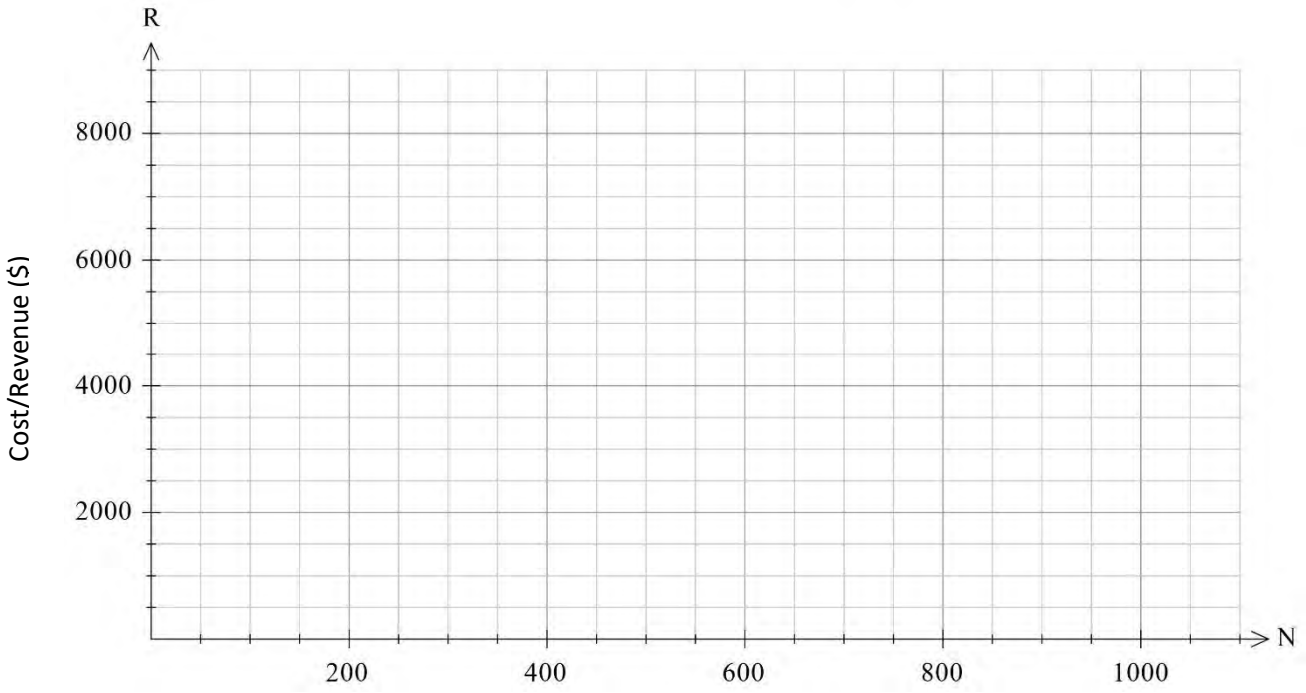
Wriggle Jiggle Ltd are a company that produce fidget spinners.

The cost ($C) of producing *N* fidget spinners is given by the equation:

$$C = 4n + 2000$$

The fidget spinners are then sold to retailers at $8 each.

Draw lines representing the cost equation (C) and revenue equation (R) on the axes below and use the graph to find the break-even point.



Number of units

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

Question 30 (4 marks)

The table below gives the future value of an annuity of $1 per period for various periods and interest rates.

Table of Future Value Interest Factors								
	Interest rate per period							
Number of Periods	0.25%	0.30%	0.35%	0.40%	0.45%	0.50%	0.55%	0.60%
53	56.5961	57.3530	58.1230	58.9063	59.7033	60.5141	61.3391	62.1785
54	57.7376	58.5250	59.3264	60.1419	60.9719	61.8167	62.6765	63.5516
55	58.8819	59.7006	60.5340	61.3825	62.2463	63.1258	64.0212	64.9329
56	60.0291	60.8797	61.7459	62.6280	63.5264	64.4414	65.3733	66.3225
57	61.1792	62.0624	62.9620	63.8786	64.8123	65.7636	66.7329	67.7204
58	62.3322	63.2485	64.1824	65.1341	66.1040	67.0924	68.0999	69.1267
59	63.4880	64.4383	65.4070	66.3946	67.4014	68.4279	69.4744	70.5415
60	64.6467	65.6316	66.6359	67.6602	68.7047	69.7700	70.8565	71.9647
61	65.8083	66.8285	67.8692	68.9308	70.0139	71.1189	72.2463	73.3965
62	66.9729	68.0290	69.1067	70.2065	71.3290	72.4745	73.6436	74.8369
63	68.1403	69.2331	70.3486	71.4874	72.6499	73.8368	75.0487	76.2859
64	69.3106	70.4408	71.5948	72.7733	73.9769	75.2060	76.4614	77.7436
65	70.4839	71.6521	72.8454	74.0644	75.3098	76.5821	77.8820	79.2101
66	71.6601	72.8670	74.1004	75.3607	76.6487	77.9650	79.3103	80.6854

a) Terry invests $350 into an annuity which pays 3% p.a. compounded monthly. What will be the value of the annuity after 5 years? **2**

……..

……..

……..

……..

b) Pam has been offered an attractive interest rate of 6% p.a. compounding annually. If she wants to achieve the same total amount as Terry after the same time, what amount should she invest per month? **2**

……..

……..

……..

……..

……..

Question 31 (2 marks)

The number (N) of non-native plants growing on an island is modelled by the equation,

$$N = 2015(1.025)^t$$

where t is the number of years since 2015 when the plants were first observed.

a) What is the annual percentage rate of increase in the number of non-native plants using this model? **1**

……..

b) Assuming the rate of increase remains the same at it is currently, in what year will the number of plants exceed 4000? **1**

……..

……..

Question 32 (2 marks)

When a constant force is applied to an object, the acceleration of the object varies inversely with its mass. When a certain constant force acts upon an object with mass 6 kg, the acceleration of the object is 11 m/s^2 . When the same force acts upon another object, its acceleration is 2 m/s^2. What is the mass (kg) of the object? **2**

……..

……..

……..

……..

……..

……..

……..

……..

Question 33 (4 marks)

Jelena borrows $24 000 through a reducing balance loan.

Interest is calculated monthly (with each month considered as $\frac{1}{12}$ of a year).

Repayments of $800.00 are deducted each month after the interest is added.

Jelena uses the spreadsheet below, to show the progress of the loan.

	A	B	C	D	E
1	*N*	*P*	*I*	*P* + *I*	*P* + *I* - *R*
2	1	$24,000.00	$160.00	$24,160.00	$23,360.00
3	2	$23,360.00	$155.73	$23,515.73	$22,715.73
4	3	$22,715.73	$151.44	$22,867.17	$22,067.17
5	4	$22,067.17	$147.11	$22,214.29	$21,414.29
6	5				***X***

a) What is the annual percentage interest rate? **2**

……..

……..

……..

……..

b) Complete the next row to find the amount ***X***, which would appear in cell E6. **2**

……..

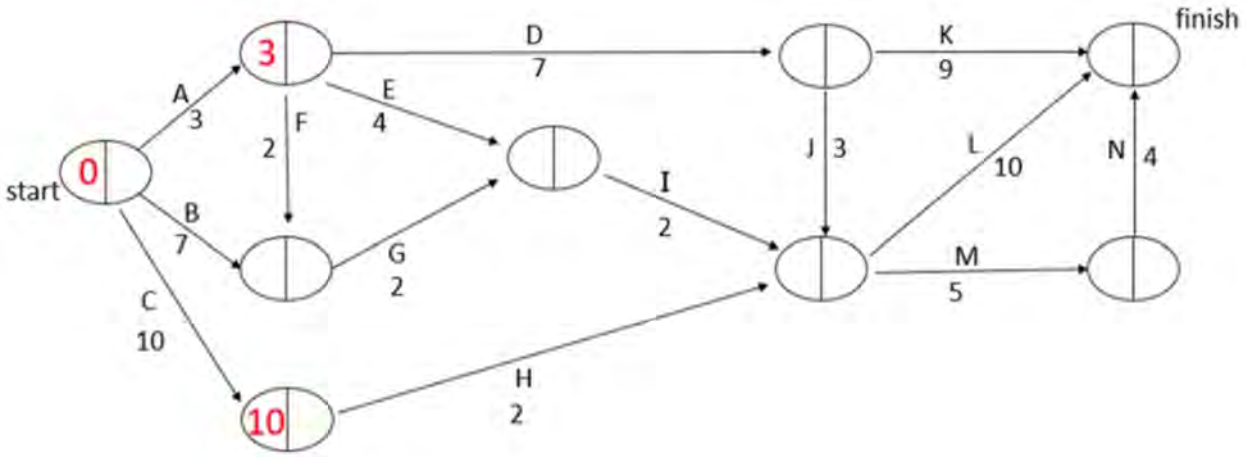
……..

……..

……..

Question 34 (4 marks)

The network diagram shows the activities to be completed to finish a project and the time (minutes) needed for each activity.



a) Complete forward and backward scans on the diagram above and state the minimum time needed to complete the project. **2**

……..

……..

b) State the critical path for this project. **1**

……..

……..

……..

……..

c) What is the float time of activity I? **1**

……..

……..

Question 35 (5 marks)

The size (in degrees, *d*) of each interior angle of a polygon with *n* sides is given by the formula

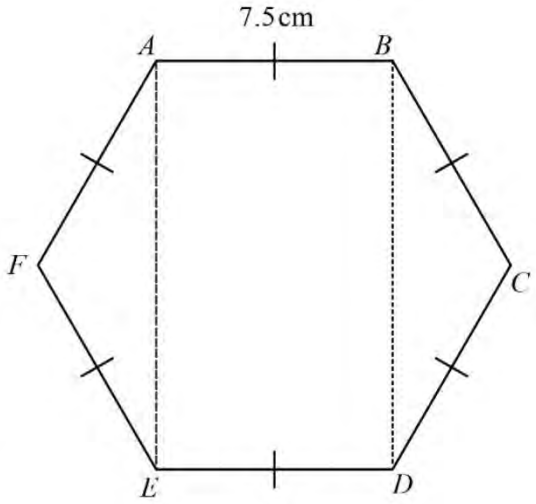
$$d = \frac{90(2n-4)}{n}$$

a) Use this formula to show that the size of each interior angle of a regular hexagon is $120°$ **1**

……..

……..

b) A regular hexagon of side lengths 7.5cm is shown below **4**



The hexagon has been divided into two triangles AEF and BCD and a rectangle ABDE as shown. Show that the area of the hexagon is approximately 146 cm^2.

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

Question 36 (4 marks)

Consider the data below about Advanced Mathematics and English results for a Year 12 examination scored by 10 students in their HSC Trial Exams. The raw score of the examination was out of 100.

Adv. Maths (x)	40	60	70	45	80	75	30	50	65	60
English (y)	70	40	38	55	40	50	85	45	45	65

a) Calculate Pearson's correlation coefficient to 3 decimal places. **1**

……..

b) Determine the equation of the regression line and use it to predict the Advanced Mathematics score of a student who scores 60 out of 100 in English **2**

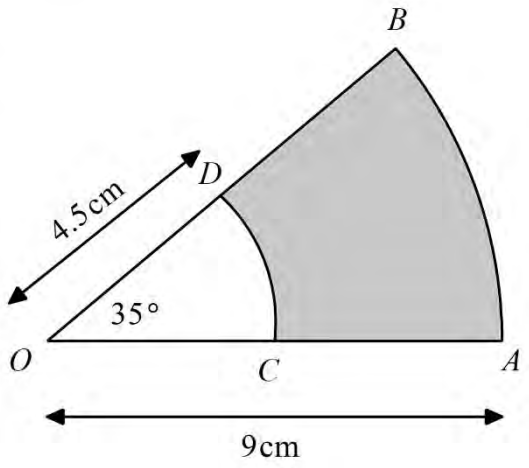
……..
……..
……..
……..
……..
……..

c) Would it be appropriate to estimate the English score of a student who scored 85 in the Mathematics Advanced Examination? **1**

……..
……..
……..
……..
……..

Question 37 (4 marks)

A sector *OAB* of radius 9cm with centre angle 35° is to be cut off as shown in the shaded area *ABCD.*



a) Calculate the area of the shaded region, correct to one decimal place. **2**

……..
……..
……..
……..

b) Calculate the perimeter of the shaded region, correct to 4 significant figures. **2**

……..
……..
……..
……..
……..
……..

Question 38 (3 marks)

Lachie and Emily are enrolled in different schools but are doing the same courses in English and Mathematics.

When they complete their Trial HSC Exams, they compare their results in Mathematics and English from their separate schools.

	English Result	Mathematics Result
Lachie (Bradman College)	68	Forgotten
Emily (Waugh High School)	68	79

The statistical results for the exams at both schools are shown below.

All of the exam results were normally distributed.

School	Mean English	Standard Deviation English	Mean Mathematics	Standard Deviation Mathematics
Bradman College	68	8	62	9
Waugh High School	74	6	64	5

a) Lachie did not remember his maths mark but did remember being told he had a z-score of +2 on the Mathematics exam. **2**

Calculate Lachie's raw maths mark and determine who performed best on their Mathematics exam, compared to their school cohort.

……..
……..
……..
……..
……..
……..

b) Determine the percentage of students that performed better than Emily in the English exam. **1**

……..
……..
……..

Question 39 (3 marks)

A loan of $450 000 is taken out over 25 years at a reducible interest rate of 6% p.a. charged monthly.

Repayments *R* are paid monthly.

Using the table of present value interest factors below and the recurrence relation,

$$A_{n+1} = A_n(1 + r) - R$$

Calculate how much interest has been charged on the loan after the second repayment.

Period	0.5%	1%	2%	4%	6%
12	12.8548	11.2552	10.5751	9.3851	8.3842
25	23.8654	22.0232	19.5235	15.6221	12.7834
36	32.8710	30.1075	25.4888	18.9083	14.6210
48	42.5803	37.9740	30.6731	21.1951	15.6500
60	51.7256	44.9550	34.7609	22.6235	16.1614
120	90.0735	69.7005	45.3554	24.7741	16.6514
240	139.5808	90.8194	49.5686	24.9980	16.6667
248	141.9441	91.5219	49.6318	24.9985	16.6667
300	155.2069	94.9466	49.8685	24.9998	16.6667
360	166.7916	97.2183	49.9599	25.000	16.6667

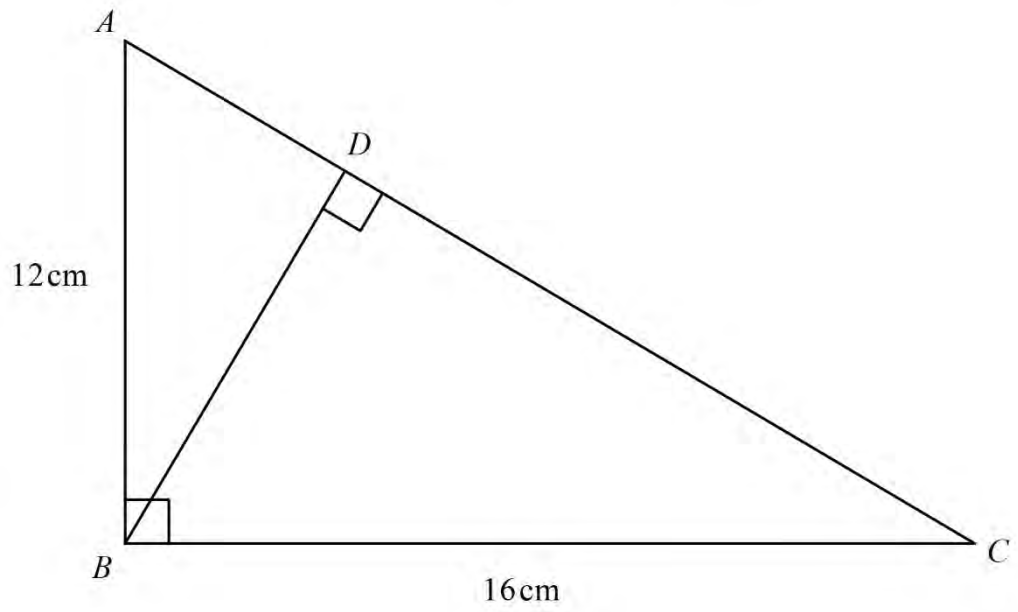
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..

4

Question 40 (4 marks)

Triangle ABC is similar to triangle BDC

$AB = 12\ cm, BC = 16\ cm$ and $\angle ABC\ and\ \angle BDC$ are both right angles.



What is the ratio of $AD:DC$?

……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..
……..

End of Task

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

REFERENCE SHEET

Measurement

Limits of accuracy

Absolute error = $\frac{1}{2} \times$ precision

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

$$A \approx \frac{h}{2}\left(d_f + d_l\right)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

$$A = \frac{1}{2}ab\sin C$$

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

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Financial Mathematics

$$FV = PV(1 + r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0(1 - r)^n$$

Statistical Analysis

An outlier is a score

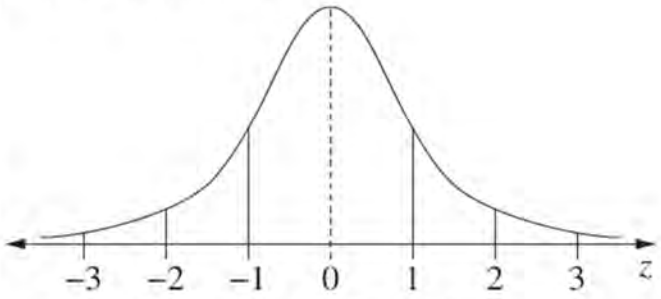
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

$$z = \frac{x - \mu}{\sigma}$$

Normal distribution



- approximately 68% of scores have z-scores between –1 and 1
- approximately 95% of scores have z-scores between –2 and 2
- approximately 99.7% of scores have z-scores between –3 and 3

Intentionally Blank Page

Merewether High School

2023 Trial Higher School Certificate Examination
Mathematics Standard 2

Name _____ Teacher *Mr D. Morrissey*

Section I – Multiple Choice Answer Sheet

Allow about 25 minutes for this section

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A ⊗ B ⊗ (correct) C ○ D ○

1.	A ○	B ○	C ○	D ○
2.	A ○	B ○	C ○	D ○
3.	A ○	B ○	C ○	D ○
4.	A ○	B ○	C ○	D ○
5.	A ○	B ○	C ○	D ○
6.	A ○	B ○	C ○	D ○
7.	A ○	B ○	C ○	D ○
8.	A ○	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ○
10.	A ○	B ○	C ○	D ○
11.	A ○	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○

MEREWETHER HIGH SCHOOL

Name: Anne Sirs

2023 Trial HIGHER SCHOOL CERTIFICATE EXAMINATION

Year 12 Mathematics Standard 2

Assessment Task 4

2023

General Instructions

- Reading time – 10 minutes
- Working Time – 2 hours and 30mins
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total Marks: 100

Section I – 15 marks (pages 2 - 9)

- Attempt Questions 1 - 15
- Allow about 25 minutes for this section

Section II – 85 marks (pages 10 - 31)

- Attempt Questions 16 - 40
- Allow about 2 hours and 5 minutes for this section

Section I

15 marks

Attempt Questions 1 – 15

Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1 - 15.

---

1 What is the value of $\sqrt{\frac{\pi^3}{2}}$ correct to 2 decimal places?

A. 2.77

B. 2.78

C. 3.93

D. 3.94

$= 3.937...$

$= 3.94$ (2dp)

2 Which of the following measurements is the same as 1.5 km^2?

A. 1.5 km × 1.5 km

B. 1.5 × 10^6 m^2

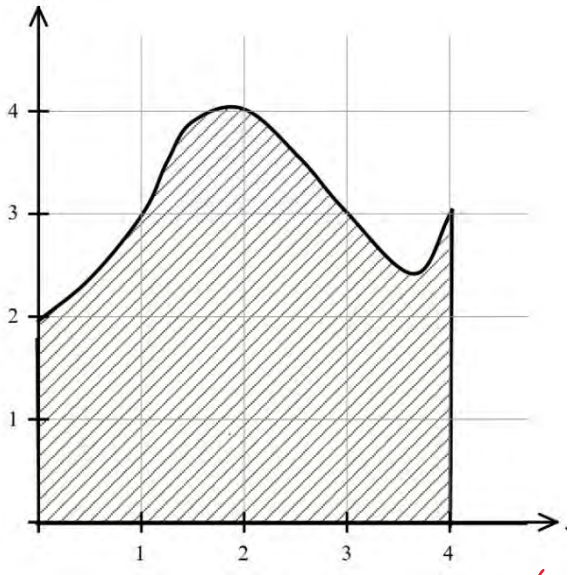
C. 1.5 × 10^9 cm^2

D. 1.5 × 10^{11} mm^2

km^2 → m^2 (× 1000^2)

× 10^6

3 Using two applications of the Trapezoidal rule, find an estimate for the area of the irregular shape shown below. (Each square on the grid is one square unit.)



$A = \frac{2}{2}(2+4) + \frac{2}{2}(4+3)$

$= 6 + 7$

A. 13.0 square units

B. 14.0 square units

C. 15.0 square units

D. 16.0 square units

4 A company pays employees a weekly retainer of $200 plus 12% commission on sales over $3500. Calculate Charlie's fortnightly pay if his sales are $8000 over the past fortnight.

$= 2 \times \$200 + 0.12 \times (8000 - 3500)$

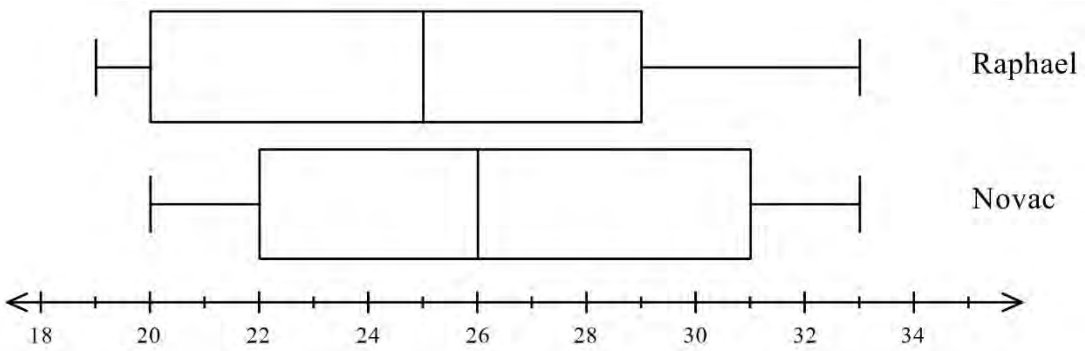
A. $740

B. $940

C. $1060

D. $1360

5 The parallel box plots below are used to compare the time taken to complete a set of tennis (to the nearest minute), by two players over their last 40 games.



Which is NOT true statement about the two sets of data?

A. They have the same interquartile range.

B. Novac has a higher median.

C. Raphael had the fastest set.

D. They both have the same upper quartile.

6 After 6 years of use a washing machine has depreciated to the value of $8000, using the declining balance method of depreciation. If the annual rate of depreciation was 12.5%, how much was the machine worth when purchased new?

A. $12 000

B. $17 826

C. $18 348

D. $19 235

$8000 = PV(1-0.125)^6$

$PV = \frac{8000}{(0.875)^6}$

7 On a business trip, Frankie plans to travel 1500 km on highways and 350 km in city traffic.

His car has estimated fuel consumption rates of 7.34 L/100 km on highways and 10.46 L/100 km in city traffic.

Calculate the amount of fuel he could expect to use on the trip.

A. 146.7 L

B. 164.7 L

C. 237.8 L

D. 329.3 L

$= 7.34 \times 15 + 10.46 \times 3.5$

8 This set of data is arranged in order from smallest to largest.

5, 6, 11, x, 13, 18, 25

The range is six less than twice the value of x. Which one of the following is true?

$20 = 2x - 6$
$2x = 26$
$x = 13$

$IQR = 18 - 6$
$= 12$

A. The median is 12 and the interquartile range is 7.

B. The median is 12 and the interquartile range is 12.

C. The median is 13 and the interquartile range is 7.

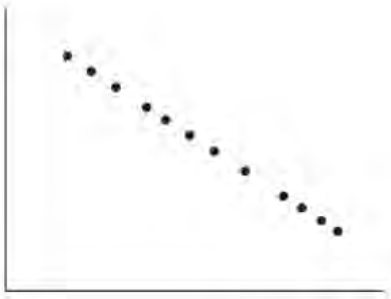
D. The median is 13 and the interquartile range is 12.

9 Which of the following graphs has the largest positive correlation coefficient value?

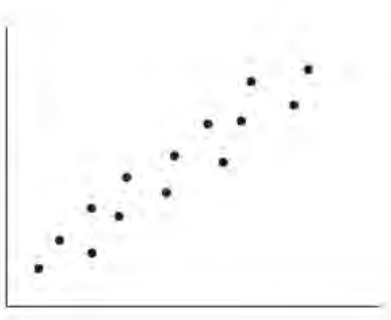
A.



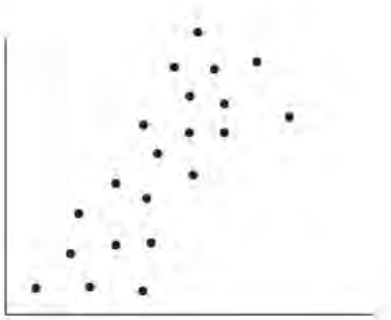
B.



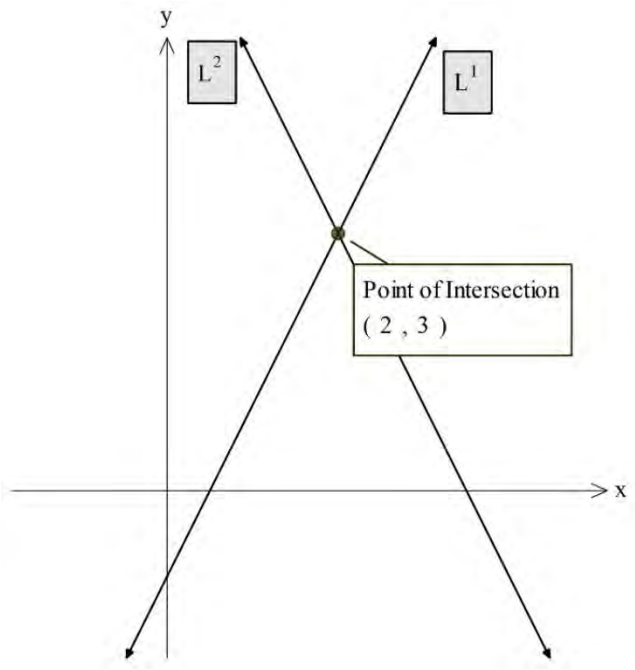
C.



D.



10 When two lines L^1 and L^2 are graphed, the simultaneous solution to the equations is shown on the graph below:



Which pair of equations could identify the two lines?

A. $y = 2x - 1 \; and \; y = -2x + 7$

B. $y = -2x + 5 \; and \; y = x + 1$

C. $y = x^2 - 2 \; and \; y = -4x + 9$

D. $y = \frac{2}{x} + 3 \; and \; y = -2x + 7$

11 Sophia is planning to take a holiday 6 months from now, and there are four options that she is considering.

Holiday	*Estimated Cost*
Kakadu Adventure	$3000
NZ Ski Trip	$6000
European Summer	$9000
Everest Base Camp	$12 000

She earns $75 000 per annum after tax and other deductions. With her weekly spending at $900 per week and bills costing her $1300 per month, she is able to save the rest for her holiday. What is the most expensive holiday she can afford?

A. Kakadu Adventure

B. NZ Ski Trip

C. European Summer

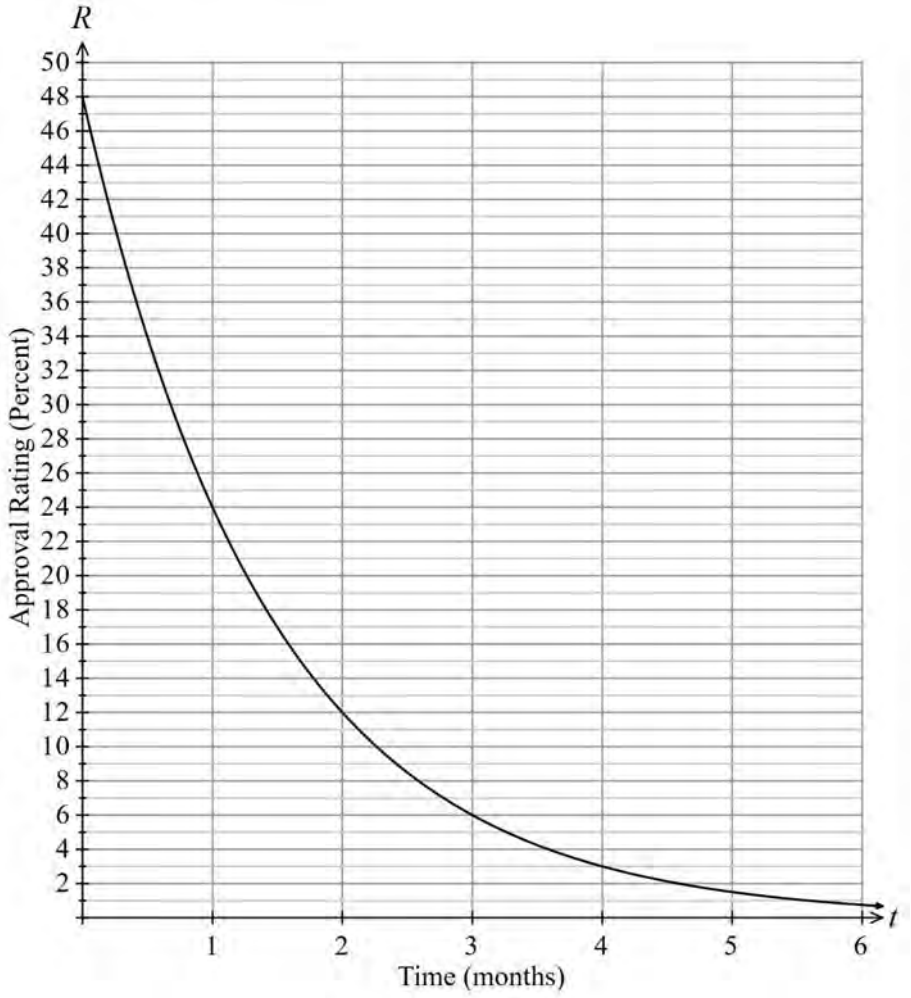
D. Everest Base Camp

$$\text{Savings} = \frac{75000 - (900 \times 52 + 1300 \times 12)}{2}$$

$$= 6,300$$

12 The approval rating of a politician falls dramatically after an election. The rate of decrease can be modelled by the equation: $R = a \times b^{-t}$, where R is the percentage approval rating, t is the time in months since the election and a and b are positive constants.

The graph below shows the relationship.



Which equation could be used to model the graph shown?

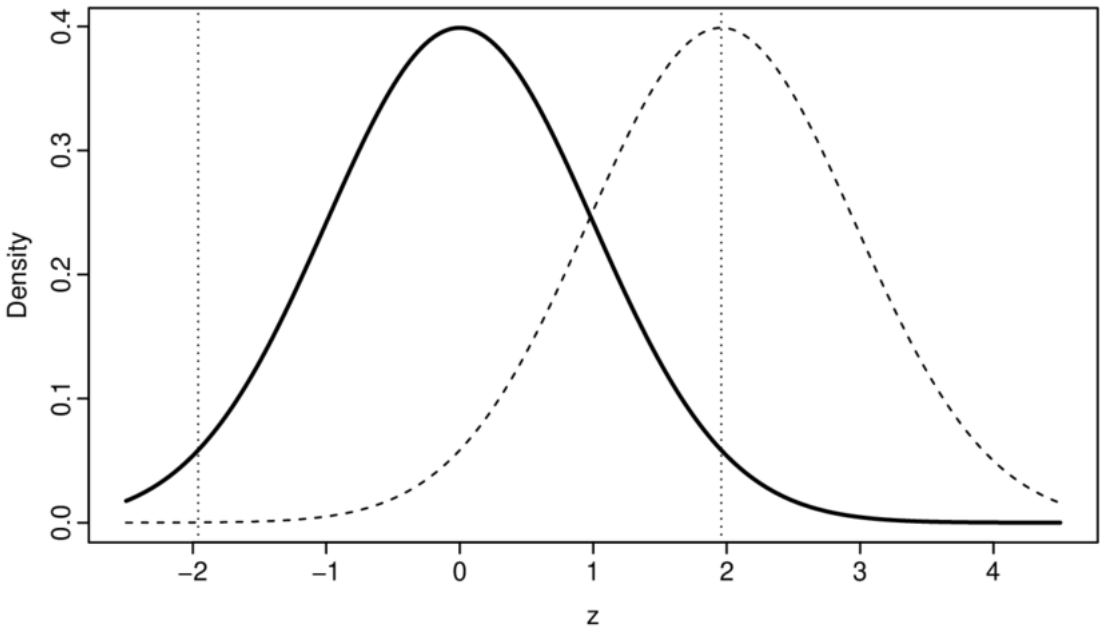
A. $R = 2 \times 48^{-t}$

B. $R = 24 \times 2^{-t}$

C. $R = 48 \times 2^{-t}$

D. $R = 48 \times 4^{-t}$

13 The following image depicts the normal distribution charts for two different groups.



Which of the following statements would best describe the data?

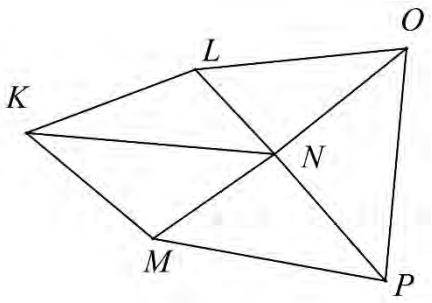
A. Both groups had the same mean but a different standard deviation.

B. Both groups had the same mean and same standard deviation.

C. Both groups had different means but the same standard deviation.

D. Both groups had different means and a different standard deviation.

14 A network diagram is shown below



How many unique paths are possible from *K* to *P*?

A. 4

B. 8

C. 12

D. 16

15 The speeds (in km/h) which are recorded on a radar device approaching a section of roadwork are normally distributed, with a mean of 58 and a standard deviation of 4.

The speed limit for the section is 60 km/h and 2400 vehicles passed the radar in one day.

How many vehicles were travelling at 2 km/h above the speed limit or more?

A. 60 vehicles

B. 384 vehicles

C. 768 vehicles

D. 1632 vehicles

z-score = +1

No. of vehicles = 0·16 × 2400

2023 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION (Assessment Task 4)

Year 12 Mathematics Standard 2

Section II Answer Booklet

85 marks

Attempt Questions 16 – 40

Allow about 2 hours and 5 minutes for this section

Instructions:

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.
- **Extra writing space is provided at the back of this booklet**. If you use this space, *note with the question you have used the extra writing space* **and** clearly indicate which question you are answering in the extra writing space.

Question 16 (2 marks)

A formula relating A and t is: $A = \frac{24}{\sqrt{t+1}}$.

a) Rewrite the formula with t as the subject. **2**

$A\sqrt{t+1} = 24$

$\sqrt{t+1} = \frac{24}{A}$

$t+1 = \left(\frac{24}{A}\right)^2$ (1) - progress

$t = \left(\frac{24}{A}\right)^2 - 1$ (2) - correct

Question 17 (3 marks)

Two teams entered a 3-point shooting contest. The points were recorded for each participant and the results are displayed in the back-to-back stem-and-leaf plot below:

Team A				Team B			
	8	6	5	0	6		
6	5	5	4	1	3	7	9	9
9	7	2	0	2	3	5	5	8
		3	1	3	4	6	7	
16					24			

a) What was the difference between the two teams median scores? **1**

diff = 24 − 16
= 8

b) Team B has a standard deviation of 9.00, calculate the standard deviation for Team A and explain what this means in terms of statistical comparison. **2**

$S_{Team\ A}$ = 9.04 (2dp) ① – std. dev. correct

② – statement about spread of scores comparison

Question 18 (2 marks)

a) A graduate has a starting gross salary of $75 000 per annum. The person is offered a 2.5% annual increase as part of their employment contract. Calculate the gross salary the person will receive at the end of their 5th year of employment. **1**

$FV = 75{,}000(1 + 0.025)^5$

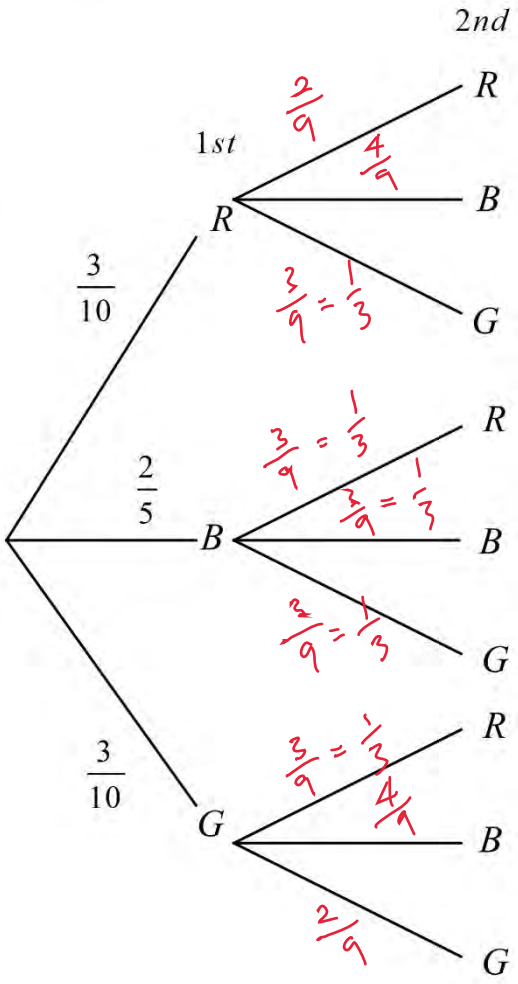
= $84,855.62

b) What will be the percentage increase overall from their starting gross salary to the salary in 5 years' time, to one decimal place? **1**

$\frac{84{,}855.62 - 75{,}000}{75{,}000} \times 100 = 13.1\%$

Question 19 (3 marks)

A bag contains 3 red, 4 blue and 3 green marbles. Two marbles are selected from the bag without replacement.



a) Complete the probability tree for the second stage branches. **1**

all correct

b) Calculate the probability of selecting marbles of the same colour. **2**

$P(\text{same, same}) = \left(\frac{3}{10} \times \frac{2}{9}\right) + \left(\frac{2}{5} \times \frac{1}{3}\right) + \left(\frac{3}{10} \times \frac{2}{9}\right)$

$= \frac{4}{15}$

$= 0.2\dot{6}$

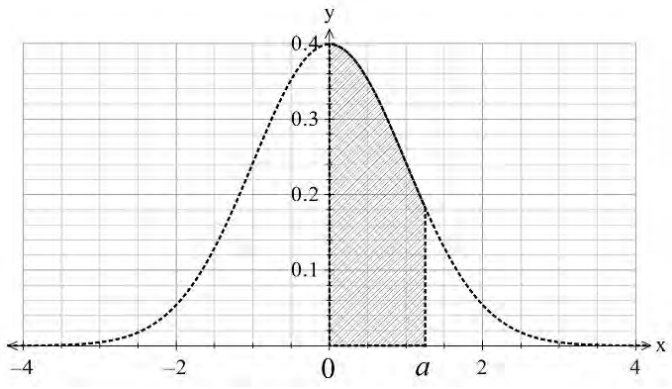
$= 26.\dot{6}\%$

(1) - progress with errors

(2) - Correct prob.

Question 20 (3 marks)

The table below shows the percentage of scores which lie between $z = 0$ and $z = a$, where a is a positive value, for a normal distribution. The table can also be used for scores to the left of $z = 0$, as the distribution is symmetrical.



z-score	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
%	0.00	3.98	7.93	11.79	15.54	19.15	22.57	25.80	28.81	31.59

a) A particular normal distribution has a mean of 30 and a standard deviation of 5. Convert a score of 33.5 from this distribution to a z-score. **1**

$z = \frac{33.5 - 30}{5}$

$= 0.7$

(1) - Correct

b) Calculate the percentage of scores in the distribution that will lie between 28 and 33.5. **2**

$z = \frac{28 - 30}{5}$

$= -0.4$

$\% = 15.54 + 25.80$

$= 41.34\%$

(1) z-score or correct %'s

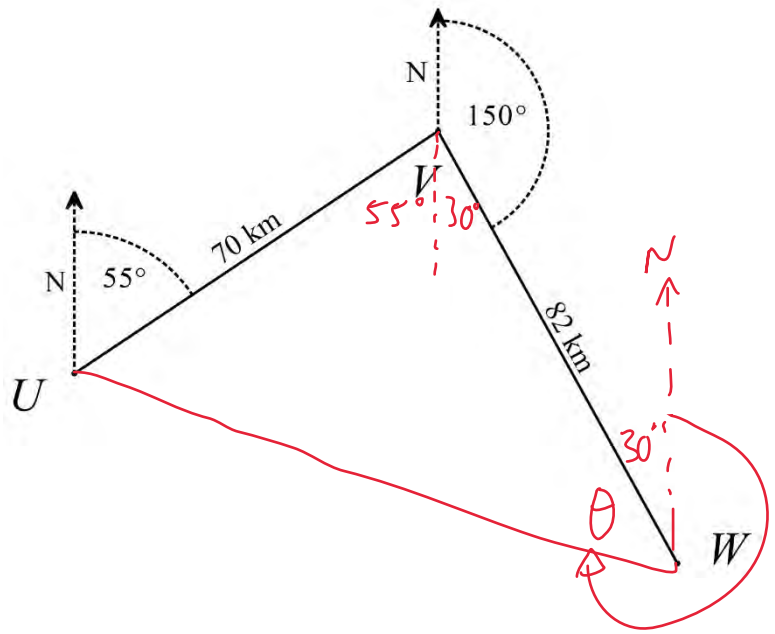
(2) Correct %

Question 21 (4 marks)

A helicopter leaves Underwood and flies 70 km on a bearing of 055° to Vanna Beach.

It then flies 82 km on a bearing of 150° to Weston.

The diagram below illustrates the journey.



a) It plans to fly directly back to Underwood. Calculate the distance, to the nearest km, that it will fly. **2**

$UW = \sqrt{70^2 + 82^2 - 2 \times 70 \times 82 \times \cos 85°}$

$= 103.07...$

$= 103$ km

① - Substitution correct with errors approach

② - Correct

b) Determine the bearing, to the nearest degree, on which it should fly from Weston to return to Underwood. **2**

$\theta = \sin^{-1}\left(\frac{70 \sin 85}{103}\right)$

$= 42° 36'$

Bearing $= 360° - (30° + 42° 36'$

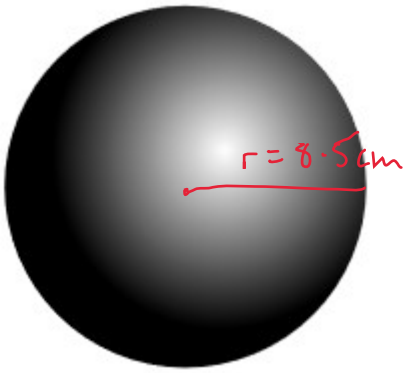
$= 287°$

① - Find θ

② - Correct Bearing

Question 22 (3 marks)

A cannon ball is made out of steel and has a diameter of 17cm.



r = 0.085m

a) Find the volume of the sphere in cubic metres. **2**

$V = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times (0.085)^3$

$= 0.00257...\ m^3$

sub. formula

(1) – incorrect radius

(2) – Correct in m^3

b) It is known that the mass of the steel used is 7.85 $tonnes/m^3$. Find the mass of the ball to the nearest gram. **1**

$Mass\ (g) = 7.85 \times 10^6 \times \left(\frac{4}{3} \times \pi \times 0.085^3\right)$

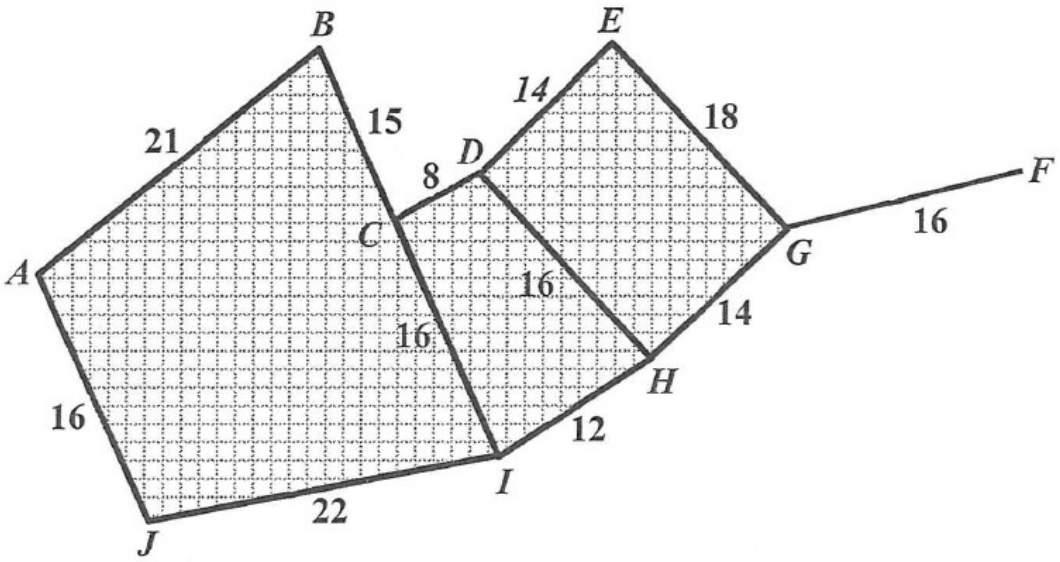
$= 20,193.6...$

$= 20,194$ grams

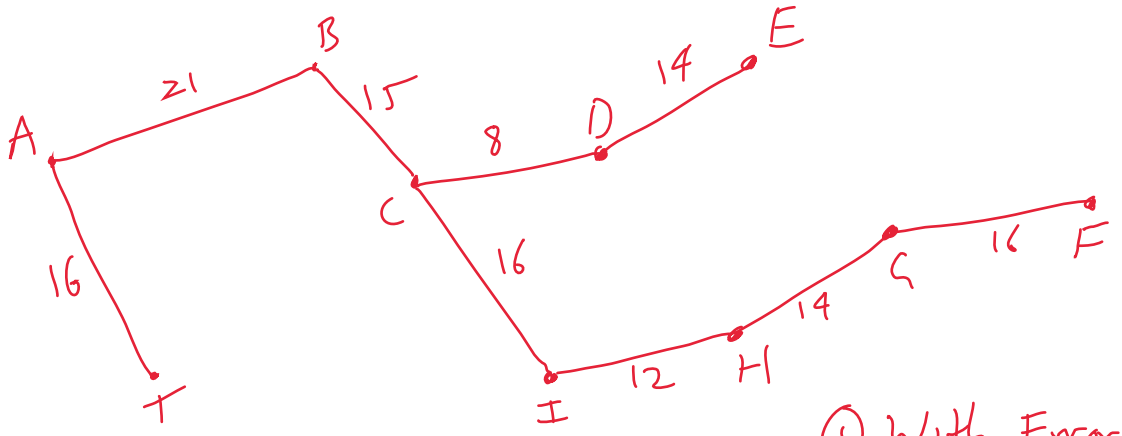
(1) Correct ± 2g

Question 23 (3 marks)

Cables are to connect the 10 junction points (A – J) in a warehouse, shown in the diagram, where the distances between the junctions are in metres.



a) Draw a minimum spanning tree below and determine the length of cable required to join all the junction points in the most efficient manner. **2**



① With Errors

② Diagram + Answer Correct

Length of cable = 132m

b) A further 5 junction points are added to a new design layout for the warehouse. State the number of edges that would form spanning tree on this new network diagram. **1**

……

9 + 5 = 14

……

Question 24 (4 marks)

A cube is measured to have a side length of 18cm, using a ruler that has markings every 10mm.

a) The cube is to be painted on the outside surface everywhere, except for the bottom face. Given that 1L of paint will cover 12 m^2, how many cubes can be painted in this way with 5L of paint? **2**

$SA = 5s^2$ $\quad 1L = \frac{12}{0.162}$

$= 5 \times 0.18^2$

$= 0.162\ m^2$ $\quad 5L = \frac{12}{0.162} \times 5$ (1) Progress with error

$= 370.37...$

$\therefore$ 370 cubes can be painted (2) Correct Answer

b) Find the upper and lower bounds for the area, to one decimal place, of one face of the cube, taking into account the measurement error. **2**

ab error $= \pm 0.5$cm

Area lower $= 17.5^2$ $\quad$ Area upper $= 18.5^2$

$= 306.25\ cm^2$ $\quad = 342.25\ cm^2$

(1) - Ab error $\quad$ (2) - Correct Areas

Question 25 (2 marks)

Sam is currently living in Sydney and wants to stream the Wallabies Rugby World Cup game which is being played in France on Saturday the 9th September at 18:00.

France is located at UTC +1 and Sydney is UTC +10.

France is subject to daylight savings time, but Sydney is not.

At what time and date in Sydney should Sam begin streaming the match? **2**

Time diff + daylight saving $= +8$ hrs

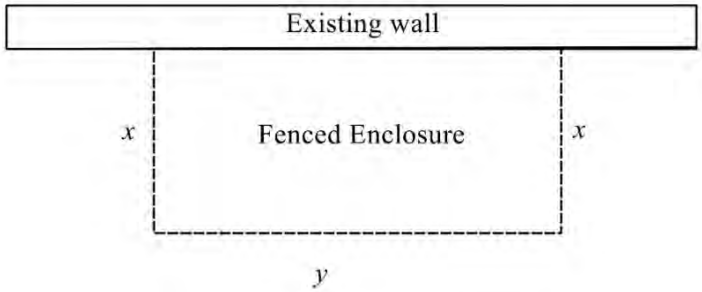
Syd is ahead $\rightarrow$ 18:00 + 8

$=$ 2am Sunday 10th September

(1) Error - daylight savings - no date $\quad$ (2) Correct Time + Date

Question 26 (4 marks)

Blair plans to build a fence against an existing wall to enclose a new area for her vegetable garden, as seen in the diagram below, using the 20 metres of wire fencing she has already purchased.

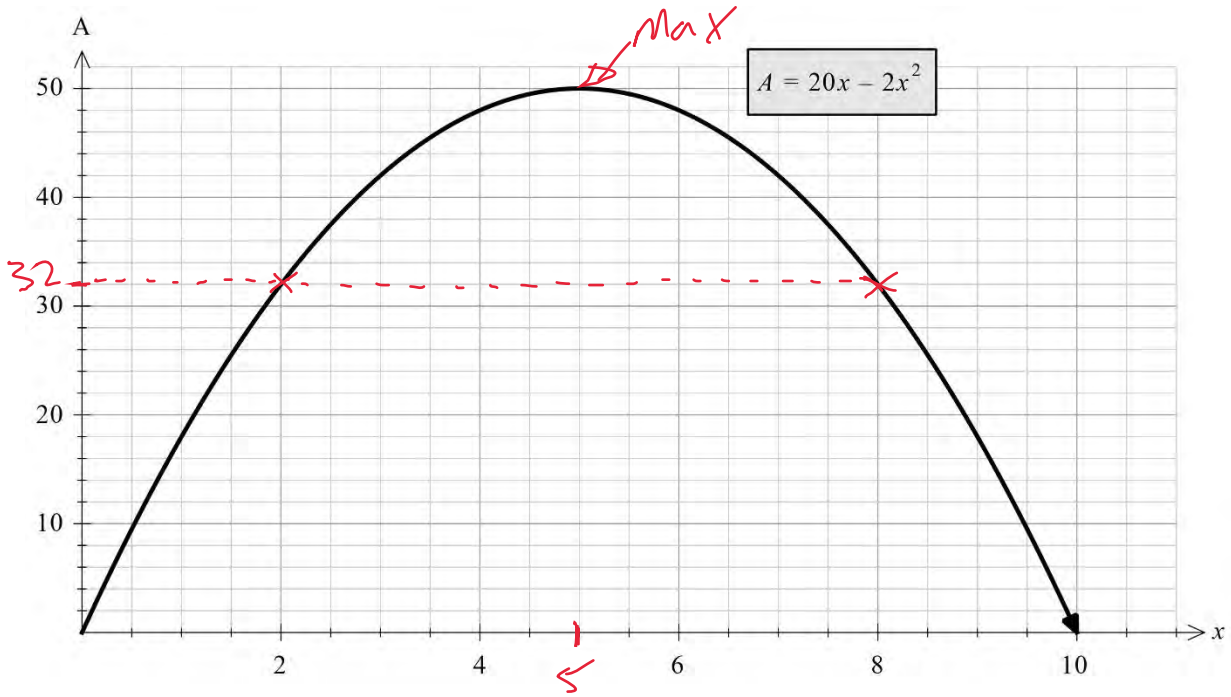


a) Write y in terms of x. Hence show that the area can be expressed as $A = 20x - 2x^2$. **1**

$y = 20 - 2x$ $A = x(20 - 2x)$

$= 20x - 2x^2$

b) The graph of $A = 20x - 2x^2$ is shown below.



Use the graph to determine the value(s) of x that would give the enclosure an area of $32m^2$ and give the dimensions of the enclosure in each case. **2**

$x = 2, y = 16$ & $x = 8, y = 4$ (1) - 1 answer

(2) - Both correct

Question 24 continues on page 19

c) Determine the dimensions that will achieve the maximum possible area for the garden bed. **1**

$x = 5$, $y = 10$

or length = 5
width = 10

(1) - Correct with both dimensions

Question 27 (5 marks)

Marnus wishes to invest $4000 over a period of 5 years.

He has researched investment accounts and needs to make a decision between the two final choices.

ACA bank pays compound interest of 4.9% p.a. compounded annually.

BMG bank pays compound interest of 4.7% p.a. compounded monthly.

a) How much extra will he earn over the 5 years by choosing the better option? **3**

$ACA = 4000(1.049)^5$

$= 5080.86$

$BMG = 4000\left(1 + \frac{0.047}{12}\right)^{60}$

$= 5057.31$

Extra = ACA − BMG

= $23.55

(1) - progress

(2) - 1 compound + Extra with error correct

(3) - Correct Extra amount

b) Find the interest rate percentage, correct to 3 decimal places, that will see Marnus's investment grow to $6000 over the 5 years if compounding annually. **2**

$6000 = 4000(1+r)^5$

$(1+r)^5 = \frac{6000}{4000}$

$1+r = \sqrt[5]{\frac{6}{4}}$

$r = \sqrt[5]{\frac{6}{4}} - 1 \times 100$

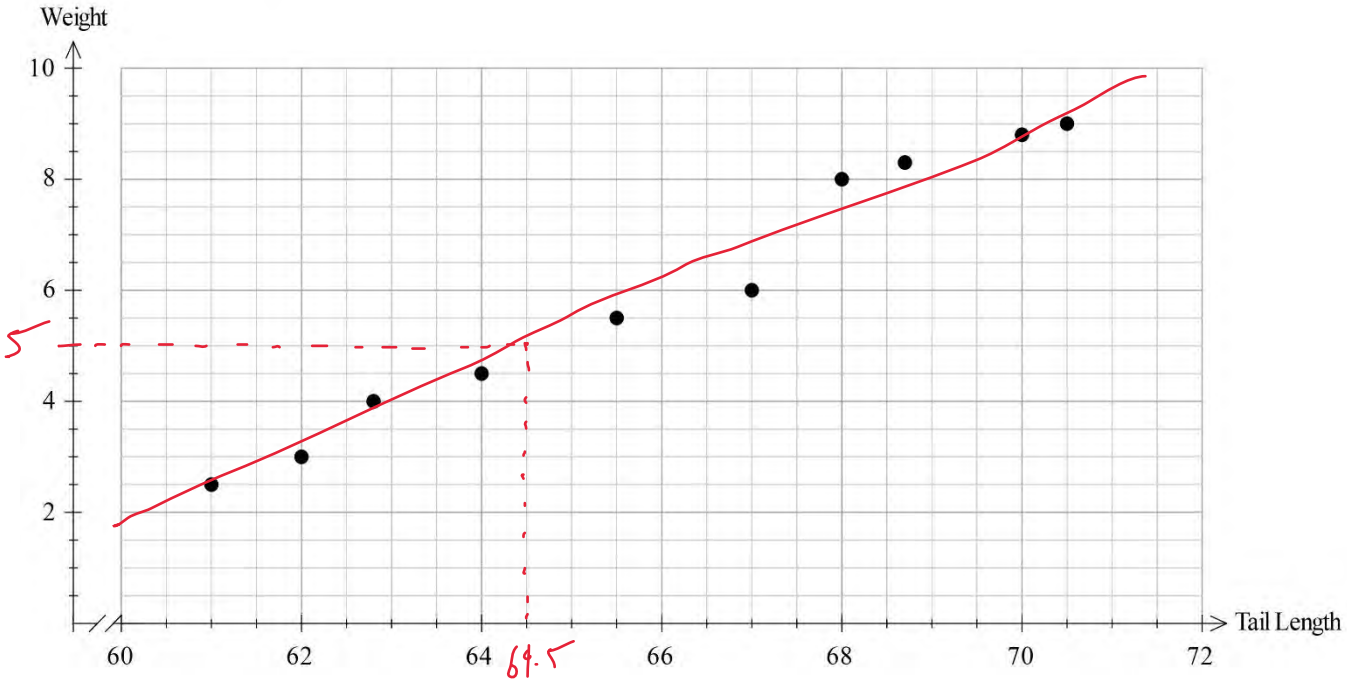
$= 8.447\%$

(1) - progress using formula

(2) - Correct %

Question 28 (5 marks)

The tail lengths (cm) and weights (kg) of 10 animals of the same species are measured and recorded in the scatterplot below.



a) Describe the strength and correlation of the two variables. **1**

strong, positive

b) Using the graph provided, apply a line of best fit and use the line to state the tail length of an animal weighing 5kg? **2**

= 64.5cm (±0.5cm)

① – Line of best fit appropriate

② – Correct from line drawn

c) Explain why this model could not be used to predict the weights of animals whose tail length is 40cms. **2**

It would give a negative answer, you cannot have negative weight.

Extrapolation is not an accurate prediction as the values are outside the dataset

Question 29 (3 marks) **3**

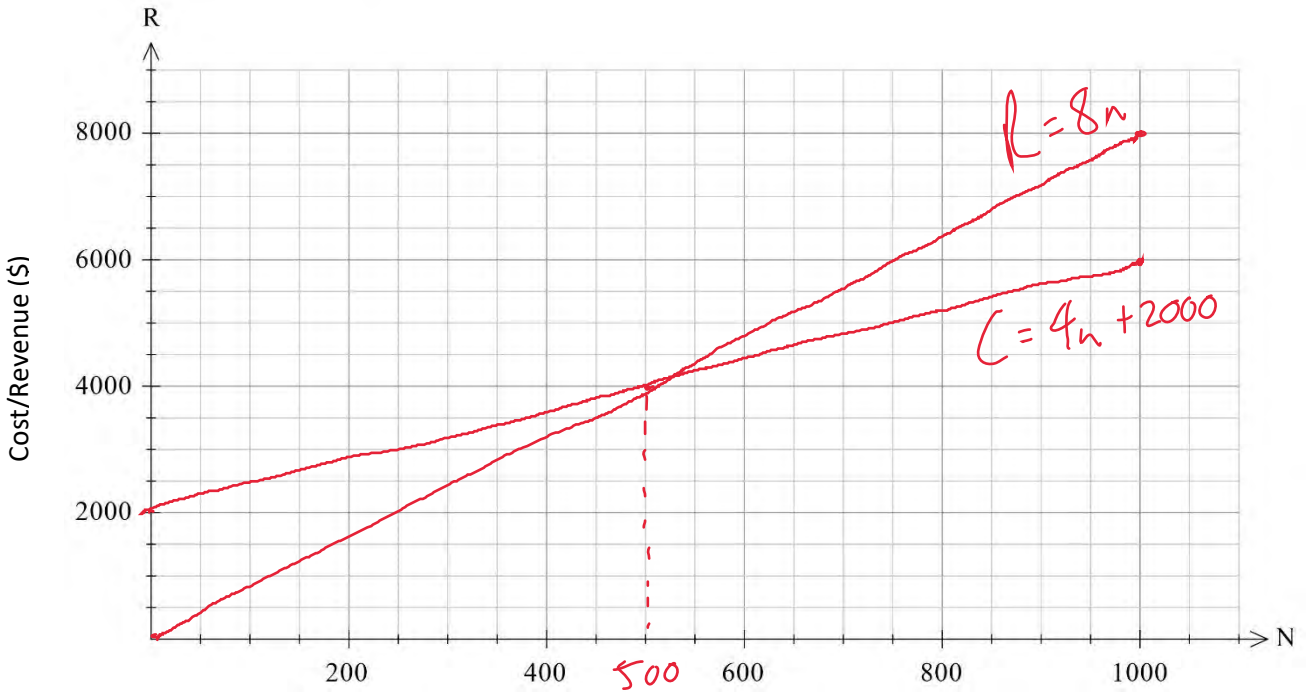
Wriggle Jiggle Ltd are a company that produce fidget spinners.

The cost ($C) of producing *N* fidget spinners is given by the equation:

$$C = 4n + 2000$$

The fidget spinners are then sold to retailers at $8 each.

Draw lines representing the cost equation (C) and revenue equation (R) on the axes below and use the graph to find the break-even point.



Number of units

$C = 4n + 2000$ $C(1000) = 4(1000) + 2000$

$= 6,000$ $(1000, 6000)$

$R = 8n$ $R(1000) = 8(1000)$

$= 8000$ $(1000, 8000)$

Breakeven Point = 500 units sold

① - correct Revenue equation

② - correctly drawn graph

③ - breakeven correct from graph.

Question 30 (4 marks)

The table below gives the future value of an annuity of $1 per period for various periods and interest rates.

Table of Future Value Interest Factors								
	Interest rate per period							
Number of Periods	0.25%	0.30%	0.35%	0.40%	0.45%	0.50%	0.55%	0.60%
53	56.5961	57.3530	58.1230	58.9063	59.7033	60.5141	61.3391	62.1785
54	57.7376	58.5250	59.3264	60.1419	60.9719	61.8167	62.6765	63.5516
55	58.8819	59.7006	60.5340	61.3825	62.2463	63.1258	64.0212	64.9329
56	60.0291	60.8797	61.7459	62.6280	63.5264	64.4414	65.3733	66.3225
57	61.1792	62.0624	62.9620	63.8786	64.8123	65.7636	66.7329	67.7204
58	62.3322	63.2485	64.1824	65.1341	66.1040	67.0924	68.0999	69.1267
59	63.4880	64.4383	65.4070	66.3946	67.4014	68.4279	69.4744	70.5415
60	64.6467	65.6316	66.6359	67.6602	68.7047	69.7700	70.8565	71.9647
61	65.8083	66.8285	67.8692	68.9308	70.0139	71.1189	72.2463	73.3965
62	66.9729	68.0290	69.1067	70.2065	71.3290	72.4745	73.6436	74.8369
63	68.1403	69.2331	70.3486	71.4874	72.6499	73.8368	75.0487	76.2859
64	69.3106	70.4408	71.5948	72.7733	73.9769	75.2060	76.4614	77.7436
65	70.4839	71.6521	72.8454	74.0644	75.3098	76.5821	77.8820	79.2101
66	71.6601	72.8670	74.1004	75.3607	76.6487	77.9650	79.3103	80.6854

a) Terry invests $350 into an annuity which pays 3% p.a. compounded monthly. What will be the value of the annuity after 5 years? **2**

$\frac{3}{12} = 0.25\%$ per month

$5 \times 12 = 60$ periods

$FV = 350 \times 64.6467$

$= \$22\,626.35$

(1) - Correct factor

(1) - FV correct using chosen factor

b) Pam has been offered an attractive interest rate of 6% p.a. compounding annually. If she wants to achieve the same total amount as Terry after the same time, what amount should she invest per month? **2**

$\frac{6}{12} = 0.5\%$ per month

$PV = \frac{FV}{69.77}$

$= \frac{22\,626.35}{69.77}$

$= \$324.30$

(1) - correct factor from table

(2) - Correct with previous FV

Question 31 (2 marks)

The number (N) of non-native plants growing on an island is modelled by the equation,

$$N = 2015(1.025)^t$$

where t is the number of years since 2015 when the plants were first observed.

a) What is the annual percentage rate of increase in the number of non-native plants using this model? **1**

2.5%

b) Assuming the rate of increase remains the same at it is currently, in what year will the number of plants exceed 4000? **1**

2015 + 28 = 2043

Question 32 (2 marks)

When a constant force is applied to an object, the acceleration of the object varies inversely with its mass. When a certain constant force acts upon an object with mass 6 kg, the acceleration of the object is 11 m/s^2 . When the same force acts upon another object, its acceleration is 2 m/s^2. What is the mass (kg) of the object? **2**

$A = \frac{k}{m}$ $A = \frac{66}{m}$

$11 = \frac{k}{6}$ $2 = \frac{66}{m}$

$k = 66$ $m = \frac{66}{2}$

$= 33$ kg

(1) - Sub in to find 'k'

(2) - Correct Mass using previous 'k' value

Question 33 (4 marks)

Jelena borrows $24 000 through a reducing balance loan.

Interest is calculated monthly (with each month considered as $\frac{1}{12}$ of a year).

Repayments of $800.00 are deducted each month after the interest is added.

Jelena uses the spreadsheet below, to show the progress of the loan.

	A	B	C	D	E
1	*N*	*P*	*I*	*P* + *I*	*P* + *I* - *R*
2	1	$24,000.00	$160.00	$24,160.00	$23,360.00
3	2	$23,360.00	$155.73	$23,515.73	$22,715.73
4	3	$22,715.73	$151.44	$22,867.17	$22,067.17
5	4	$22,067.17	$147.11	$22,214.29	$21,414.29
6	5	21,414.29	142.76	21,557.05	***X***

a) What is the annual percentage interest rate? **2**

$R = \frac{160}{24,000} \times 12$

$= 0.08 = 8\%$ p.a.

(1) - monthly or sub. into $I = PRN$

(2) - Correct annual %

b) Complete the next row to find the amount ***X***, which would appear in cell E6. **2**

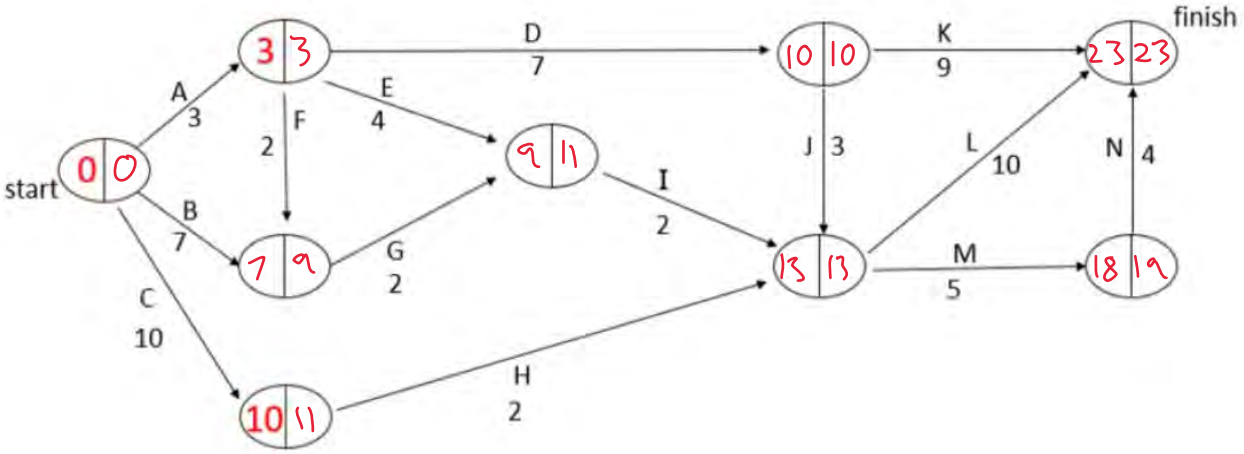
$21,557.05 - 800 = \$20,757.05$

(1) Completed with errors

(2) - Correct Value

Question 34 (4 marks)

The network diagram shows the activities to be completed to finish a project and the time (minutes) needed for each activity.



a) Complete forward and backward scans on the diagram above and state the minimum time needed to complete the project. **2**

23 mins ① completed diagram

② correct time

b) State the critical path for this project. **1**

A - D - J - L

c) What is the float time of activity I? **1**

LST - EST = 11 - 9

= 2 mins

Question 35 (5 marks)

The size (in degrees, d) of each interior angle of a polygon with n sides is given by the formula

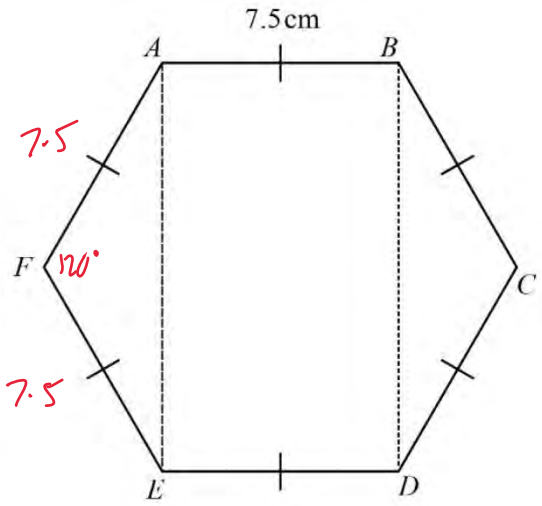
$$d = \frac{90(2n-4)}{n}$$

a) Use this formula to show that the size of each interior angle of a regular hexagon is 120° **1**

$d = \frac{90(2(6)-4)}{6}$

$= \frac{90 \times 8}{6} = 120°$

b) A regular hexagon of side lengths 7.5cm is shown below **4**



The hexagon has been divided into two triangles AEF and BCD and a rectangle ABDE as shown. Show that the area of the hexagon is approximately 146 cm^2.

$AE = \sqrt{7.5^2 + 7.5^2 - 2 \times 7.5^2 \cos 120°}$

$= 12.99$ ..

Area $= 2 \times \frac{1}{2} ab \sin C$ + rectangle

$= 7.5^2 \sin 120° + 7.5 \times 12.99 \ldots$

$= 146.1 \text{ cm}^2$

① - length AE

① - Area of triangle

① - Area of rectangle

① - Correct Area of hexagon

Question 36 (4 marks)

Consider the data below about Advanced Mathematics and English results for a Year 12 examination scored by 10 students in their HSC Trial Exams. The raw score of the examination was out of 100.

Adv. Maths (x)	40	60	70	45	80	75	30	50	65	60
English (y)	70	40	38	55	40	50	85	45	45	65

a) Calculate Pearson's correlation coefficient to 3 decimal places. **1**

-0.777 (3 dp)

b) Determine the equation of the regression line and use it to predict the Advanced Mathematics score of a student who scores 60 out of 100 in English **2**

$y = A + Bx$

$= 96.50 - 0.75x$

(1) - Equation

$60 = 96.5 - 0.75x$

$0.75x = 36.5$

$x = 48.6$

(1) - Correct from Equation

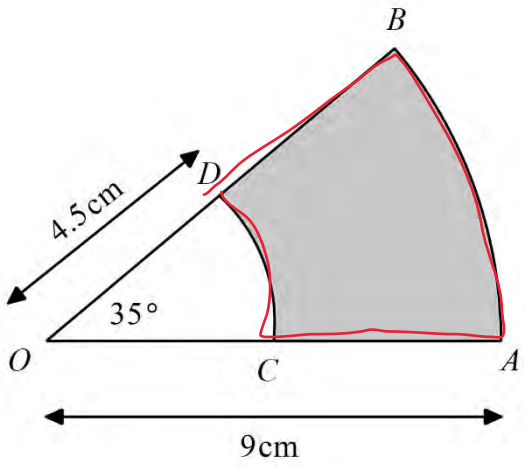
c) Would it be appropriate to estimate the English score of a student who scored 85 in the Mathematics Advanced Examination? **1**

(1) - Appropriate statement.

"While this score is outside the range, the correlation suggests a strong negative correlation..."

Question 37 (4 marks)

A sector *OAB* of radius 9cm with centre angle 35° is to be cut off as shown in the shaded area *ABCD*.



a) Calculate the area of the shaded region, correct to one decimal place. **2**

Area shaded $= \left(\frac{35}{360} \times \pi \times 9^2\right) - \left(\frac{35}{360} \times \pi \times 4.5^2\right)$

$= 18.55\ldots$

$= 18.6\ cm^2$ (1 dp)

(1) - progress with errors.

(2) - Correct

b) Calculate the perimeter of the shaded region, correct to 4 significant figures. **2**

$P = 9 + \left(\frac{35}{360} \times 2\pi \times 4.5\right) + \left(\frac{35}{360} \times 2\pi \times 9\right)$

$= 17.296\ldots$

$= 17.25\ cm$ (4 sig fig)

(1) progress with error

(2) - Correct

Question 38 (3 marks)

Lachie and Emily are enrolled in different schools but are doing the same courses in English and Mathematics.

When they complete their Trial HSC Exams, they compare their results in Mathematics and English from their separate schools.

	English Result	Mathematics Result
Lachie (Bradman College)	68	Forgotten
Emily (Waugh High School)	68	79

The statistical results for the exams at both schools are shown below.

All of the exam results were normally distributed.

School	Mean English	Standard Deviation English	Mean Mathematics	Standard Deviation Mathematics
Bradman College	68	8	62	9
Waugh High School	74	6	64	5

a) Lachie did not remember his maths mark but did remember being told he had a z-score of +2 on the Mathematics exam. **2**

Calculate Lachie's raw maths mark and determine who performed best on their Mathematics exam, compared to their school cohort.

Lachie

$2 = \frac{x - 62}{9}$

$x = 80$

z-score of 2

Emily

$x = 79$

$z = \frac{79 - 64}{5}$

$= 3$

∴ Emily performed better as she was in the top 0.15% of her cohort.

(1) Lachie z-score

(1) statement correct about who performed better.

b) Determine the percentage of students that performed better than Emily in the English exam. **1**

$z = \frac{68 - 74}{6}$

$= -1$

∴ 84% of scores higher than -1.

Question 39 (3 marks)

A loan of $450 000 is taken out over 25 years at a reducible interest rate of 6% p.a. charged monthly.

Repayments R are paid monthly.

Using the table of present value interest factors below and the recurrence relation,

$$A_{n+1} = A_n(1 + r) - R$$

Calculate how much interest has been charged on the loan after the second repayment.

Period	0.5%	1%	2%	4%	6%
12	12.8548	11.2552	10.5751	9.3851	8.3842
25	23.8654	22.0232	19.5235	15.6221	12.7834
36	32.8710	30.1075	25.4888	18.9083	14.6210
48	42.5803	37.9740	30.6731	21.1951	15.6500
60	51.7256	44.9550	34.7609	22.6235	16.1614
120	90.0735	69.7005	45.3554	24.7741	16.6514
240	139.5808	90.8194	49.5686	24.9980	16.6667
248	141.9441	91.5219	49.6318	24.9985	16.6667
300	155.2069	94.9466	49.8685	24.9998	16.6667
360	166.7916	97.2183	49.9599	25.000	16.6667

$R = \frac{450,000}{155.2069}$

$= \$2899.36$

1st mth $= 450,000(1.005) - 2899.36$

$= 449,350.64$

2nd mth $= 449,350.64(1.005) - 2899.36$

$= 448,698.03$

Loan diff $= 450,000 - 448,698.03$

$= 1301.97$ OK

Interest charged $= 2 \times 2899.36 - 1301.97$

$= \$4496.75$

Interest charged $= 450,000 \times 0.005 + 449,350.64 \times 0.005$

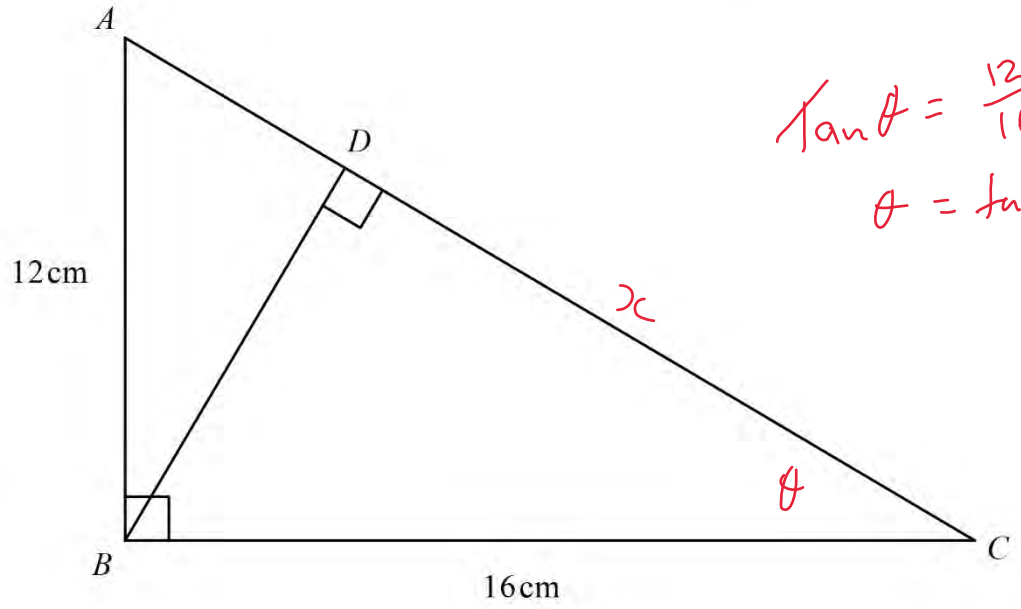
$= \$4496.75$

(1) - Correct 'R' (1) - balance after 2 mths (1) Interest correct from previous

Question 40 (4 marks)

Triangle ABC is similar to triangle BDC

$AB = 12\ cm$, $BC = 16\ cm$ and $\angle ABC$ *and* $\angle BDC$ are both right angles.



$\tan\theta = \frac{12}{16}$

$\theta = \tan^{-1}\left(\frac{12}{16}\right)$

What is the ratio of $AD : DC$?

$AC = \sqrt{12^2+16^2} = 20cm$ (1) – length AC

$\frac{CD}{BC} = \frac{BC}{AC}$ (1) – length CD

$\frac{CD}{16} = \frac{16}{20}$ (1) – length AD

$CD = 12.8$ (1) – Correct Ratio

$AD = 20 - 12.8 = 7.2$

Ratio of $AD : DC = 7.2 : 12.8$

$= 9 : 16$

End of Task