Student's Name:_____ Teacher's Code: _____

Saint Ignatius' College, Riverview
Mathematics Assessment Task
2024

Year 12
Mathematics Standard 2
HSC Trial Assessment Task
Date: Friday 23rd August 2024

General Instructions

- **Reading time: 10 minutes**
- **Time Allowed: 2 hours 30 minutes**
- Write using black or blue pen.
- Calculators approved by NESA may be used.
- A NESA reference sheet is provided.
- Attempt all questions in the space provided on the paper.
- Write **your name** and **your teacher's code** in the positions indicated.
- Marks may not be awarded for missing or carelessly arranged working.
- **Diagrams are not drawn to scale.**

Teachers:

- Mr A Chan AZC
- Mr D Hyde DXH
- Mrs F Yates FEY
- Ms M Kim MYK
- Dr M Furtado/ Mr G Abrahams MXF

Section 1 Multiple Choice	**15 Marks**
Section 2 Extended Response	**22 Marks**
Section 3 Extended Response	**20 Marks**
Section 4 Extended Response	**20 Marks**
Section 5 Extended Response	**23 Marks**
Total	**100 Marks**

Section 1

15 Marks

Questions 1 – 15 are multiple choice

Select the best response and shade your answer on the corresponding answer sheet provided.

Question 1

The ratio of adults to children at a Wiggles concert is 5 : 9.
How many adults are at the concert if there are 630 children?

A. 45

B. 70

C. 225

D. 350

Question 2

A piece of timber is measured to be 1.64 m long. The percentage error is closest to:

A. $\pm 0.03\%$

B. $\pm 0.3\%$

C. $\pm 3\%$

D. $\pm 30\%$

Question 3

A car travels 480 km on 60 L of petrol. What is its fuel consumption in L/100km?

A. 0.125 L/100 km

B. 8 L/100 km

C. 12.5 L/100 km

D. 28.8 L/100 km

Question 4

Scott bought a new freezer for $1800. It has an energy consumption of 488 kWh per year.

Energy is charged at a rate of $0.35/kWh.

How much will it cost to purchase and then run the freezer for 5 years?

A. $854.00

B. $1970.80

C. $2654.00

D. $9854.00

Question 5

The water usage charge for a non-residential property is $1.80/kL for the first 250 kL and $2.20/kL for any consumption over 250 kL. What is the cost if the amount of water consumed is 480 kL?

A. $864

B. $956

C. $1056

D. $1506

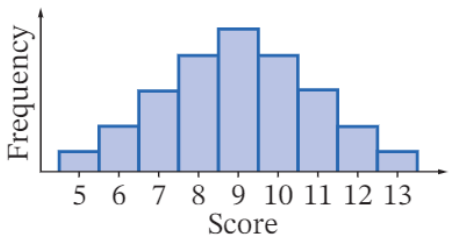
Question 6

Which of the data sets below represents a distribution that is negatively skewed?

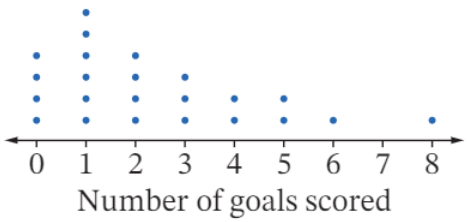
A.

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

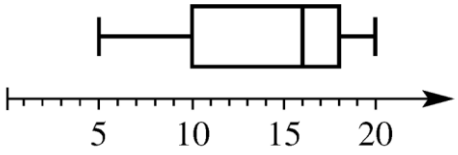
B.



C.

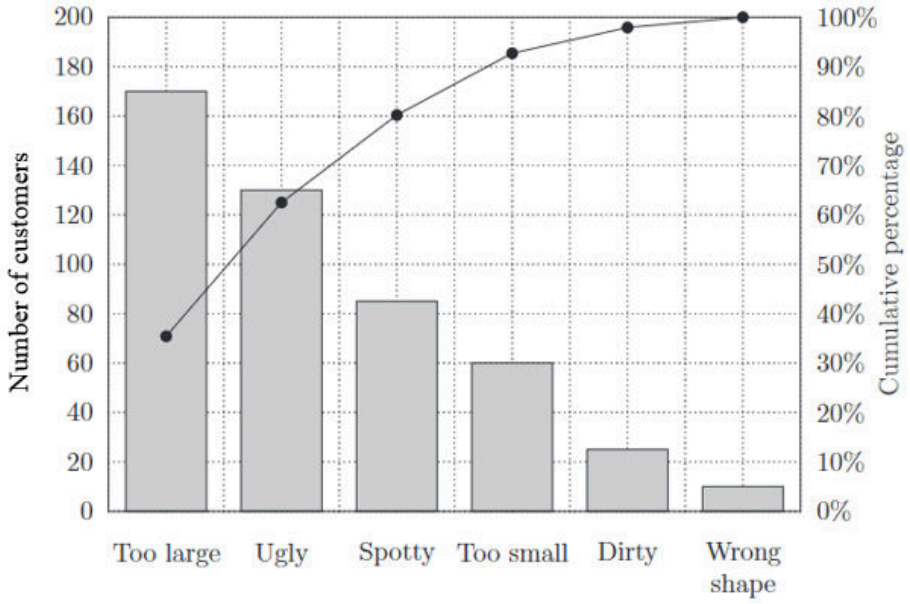


D.



Question 7

The Pareto Chart below shows the reasons given by customers who returned an item purchased from an online store.



Use the chart to estimate the percentage of items that were returned for being 'Too small'.

A. 13%

B. 30%

C. 60%

D. 93%

Question 8

Benjamin is given 1.8 litres of fluid over 10 hours by intravenous drip.

The fluid is delivered at a rate of 30 drops per mL.

What is required drip rate, in drops per minute?

A. 15 drops/minute

B. 90 drops/minute

C. 0.15 drops/minute

D. 3.6 drops/minute

Question 9

The table below shows the monthly repayments **per $100 000** borrowed with reducible interest.

Interest Rate (% p.a.)	Term of Loan				
	5 years	10 years	15 years	20 years	25 years
6.50	1956.61	1135.48	871.11	745.57	675.21
6.75	1968.35	1148.24	884.11	760.36	690.91
7.00	1980.12	1161.08	898.83	775.30	706.78
7.25	1991.94	1174.01	912.86	790.38	722.81
7.50	2003.79	1187.02	927.01	805.59	738.99
7.75	2015.70	1200.11	941.28	831.79	755.33

James bought an apartment for $250 000. He borrowed the amount at 7.25% p.a. interest. The loan is to be repaid monthly over 10 years. Using the table above, which value is closest to the **total amount** that James will repay?

A. $140 881.20

B. $293 502.50

C. $348 324.00

D. $352 203.00

Question 10

A carpark contains only Black, White, Grey, Red and Blue cars.
The table below shows the relative frequency of selecting each colour of car at random.
The probability that a car selected at random is **not Grey** is 0.83.

Colour	Relative Frequency
Black	0.27
White	
Grey	
Red	0.31
Blue	0.12

If there are 500 cars in total in the car park, how many of them are **White**?

A. 65

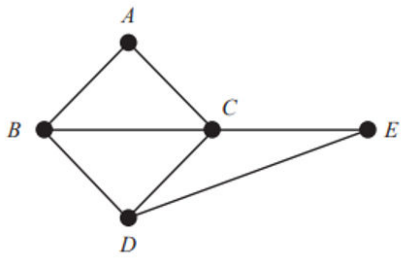
B. 75

C. 85

D. 150

Question 11

A country has five states A, B, C, D, and E. A network has been drawn below with vertices to represent each of the states. Edges represent a border shared between two states.



The diagram below shows the position of state A on a map of this country. The four other states are indicated on the diagram as 1, 2, 3 and 4.

Use this information to find the correct table that matches the state (B, C, D and E) with the corresponding number (1, 2, 3 and 4).

A.

State	State number
B	4
C	3
D	1
E	2

B.

State	State number
B	3
C	2
D	4
E	1

C.

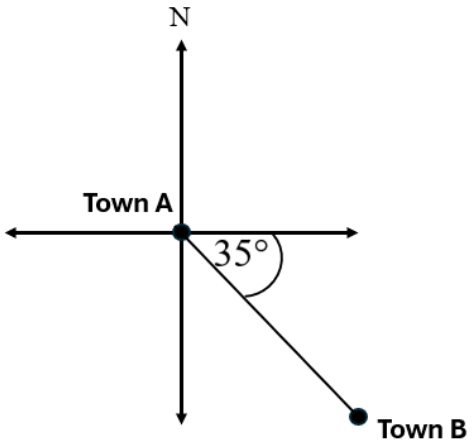
State	State number
B	2
C	3
D	4
E	1

D.

State	State number
B	3
C	2
D	1
E	4

Question 12

What is the compass bearing of Town A from Town B in the diagram below?



A. S35°E

B. S55°E

C. N35°W

D. N55°W

Question 13

The results of a recent Biology exam for Mr Smith's class are Normally Distributed with a **mean mark of 60**. His students achieved the following results.

29 44 46 49 55 55 57 61 63 65 73 74 78 91

Using the population standard deviation, how many scores have a z-score greater than 1.5?

A. 0

B. 1

C. 2

D. 3

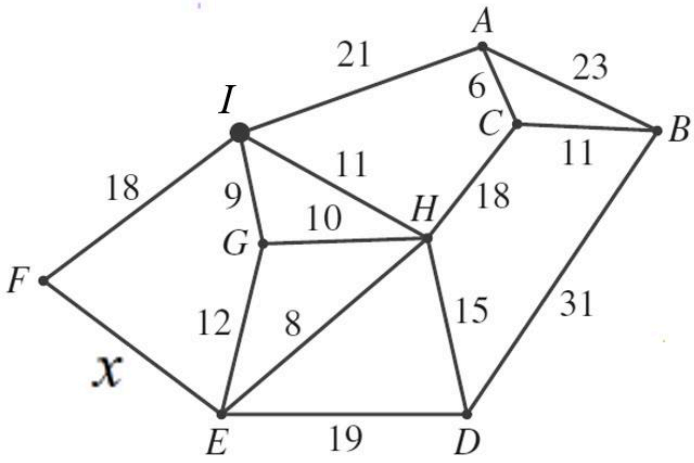
Question 14

The network below shows the distances in kilometres between 9 power substations (*A* to *I*).

The minimum length of cable required to ensure power can reach all substations is **93km**.

It is known that there will certainly be a cable connecting substations E and F.

Use this information to find the length of the cable x between E and F.



A. 12km

B. 13km

C. 16km

D. 18km

Question 15

There are three numbers $x,\ y, \text{and}\ z$ and it is known that

$$y = 2x$$
$$z = 5y$$

Find $x : z$

A. 2 : 5

B. 5 : 2

C. 1 : 10

D. 10 : 1

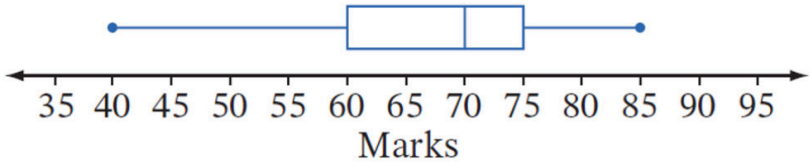
END OF SECTION 1

Student's Name:_____ Teacher's Code: _____

Section 2 (22 marks)

Question 16 (4 marks)

The dot plot below shows the results for a Year 12 History test. There are **120 students** in the course.



a) What is the median score? **1**

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b) How many students scored at least 60 in the test? **1**

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c) One student was absent and completed the test the following week. **2**
He scored 95 and claims his result is an outlier.
Is he correct? Support your answer showing suitable working.

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Question 17 (2 marks)

Finn is studying the population of rabbits in a park.
On Monday he catches a random sample of 80 rabbits, marks each rabbit with a tag and releases them back into the park. On Tuesday, he catches a random sample of 42 rabbits and sees that 12 of them are marked with a tag. Estimate the number of rabbits in the park. **2**

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Question 18 (5 marks)

a) Young's rule is used to prescribe medicine for children. The formula is shown below.

$$D = \frac{yA}{y+12}$$

D = child's dosage in mg

y = child's age in years

A = adult's dosage in mg.

What is the dosage, D, for a 3 year old child if the adult dosage is 45mg? **1**

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b) Make y the subject of the formula $x = 5(y - z)$ **2**

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c) Solve $\frac{7x-10}{3} = 4x$ **2**

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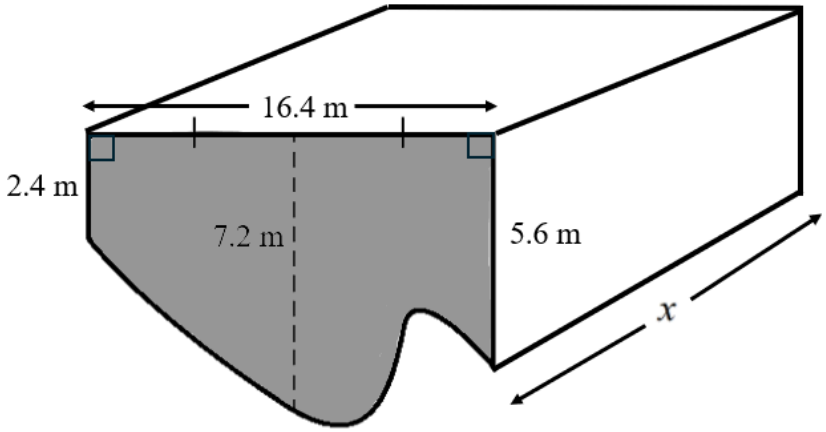
Question 19 (3 marks)

The dam on Danny's property has a uniform cross-section, shaded in the diagram below.



a) Use two applications of the trapezoidal rule to show that the area of the cross-section is approximately 91.84 m^2. **2**

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b) When the dam is full, it holds 2.296 Megalitres of water. **1**
What is the length of the dam (x) in metres? (Note: 1 ML = 1000 kL)

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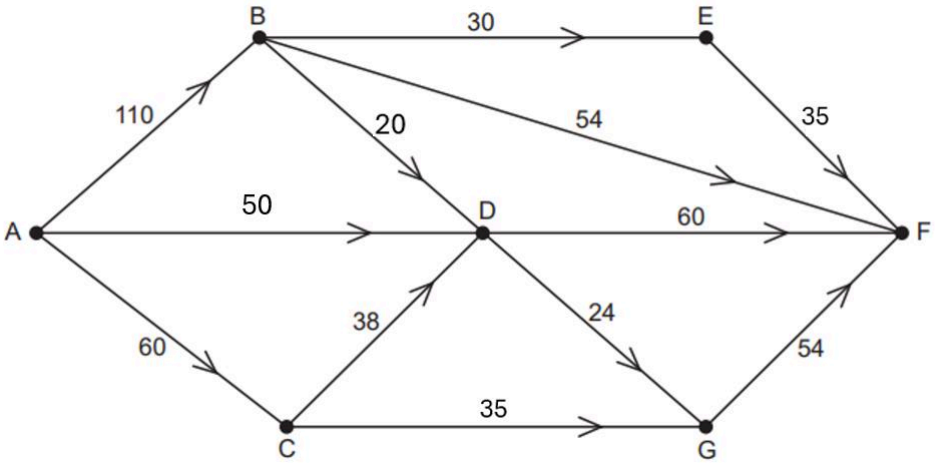
Question 20 (4 marks)

A ferry service connects a group of islands in the Pacific Ocean.

The network below shows the **number of passengers** that can be carried between each island, A, B, C, D, E, F and G.



a) What is the maximum number of passengers that can be carried from A to F each hour? **2**

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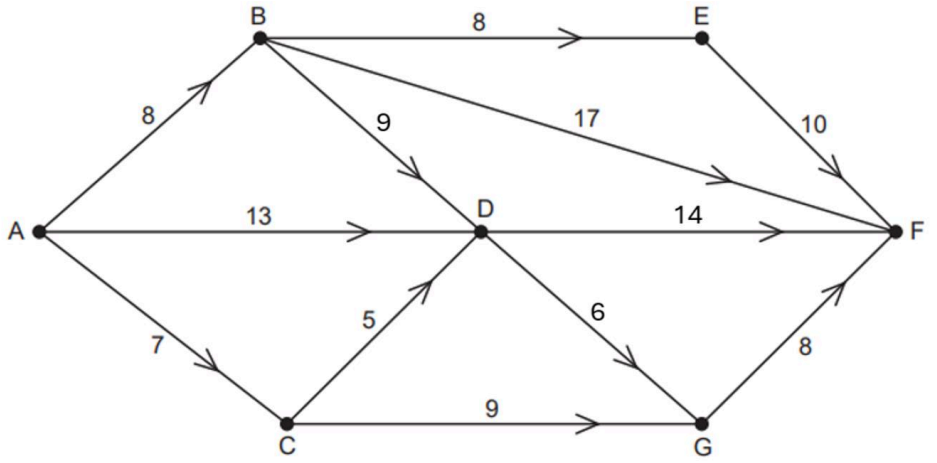
b) The network below now shows the **distance in kilometers** between the islands.



Passengers are charged a **$12 booking fee plus $1.50 for every kilometre** they plan to travel.

Calculate the **minimum cost** of travelling from Island A to Island F. **2**

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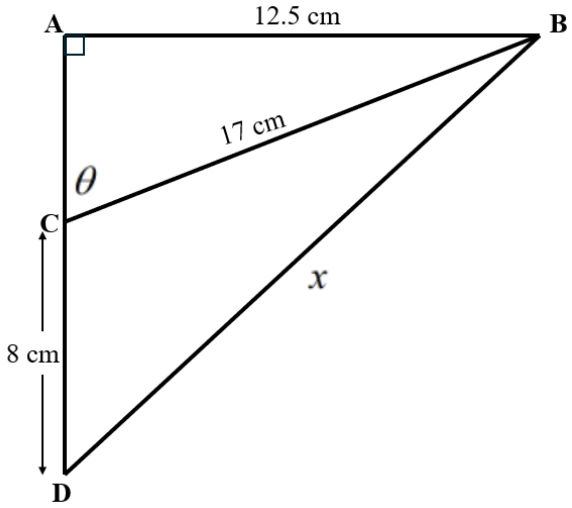
Question 21 (4 marks)

Consider the diagram below.



a) Show that $\angle ACB = 47°$ to the nearest degree. **2**

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b) Calculate the length of side BD correct to 1 decimal place. **2**

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END OF SECTION 2

Student's Name:_____ Teacher's Code: _____

Section 3 (20 marks)

Question 22 (2 marks)

Oliver is a car salesman and earns a weekly retainer of $450 plus 4% commission on any sales.
Last week he sold only a car worth $37 000.
Calculate his total earnings for last week. **2**

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Question 23 (3 marks)

a) When John is completing high intensity exercise, his pulse rate is 160 beats/minute and his heart pumps 28 L of blood every minute. How many millilitres of blood does John's heart pump with each beat when he is doing high intensity exercise? **1**

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b) John burns on average 360 kilojoules (kJ) every 15 minutes when running.
John consumes a sandwich containing 1728 kJ before going on a run.
How long does he need to run to burn off the energy contained in the sandwich?
Write your answer in hours and minutes. **2**

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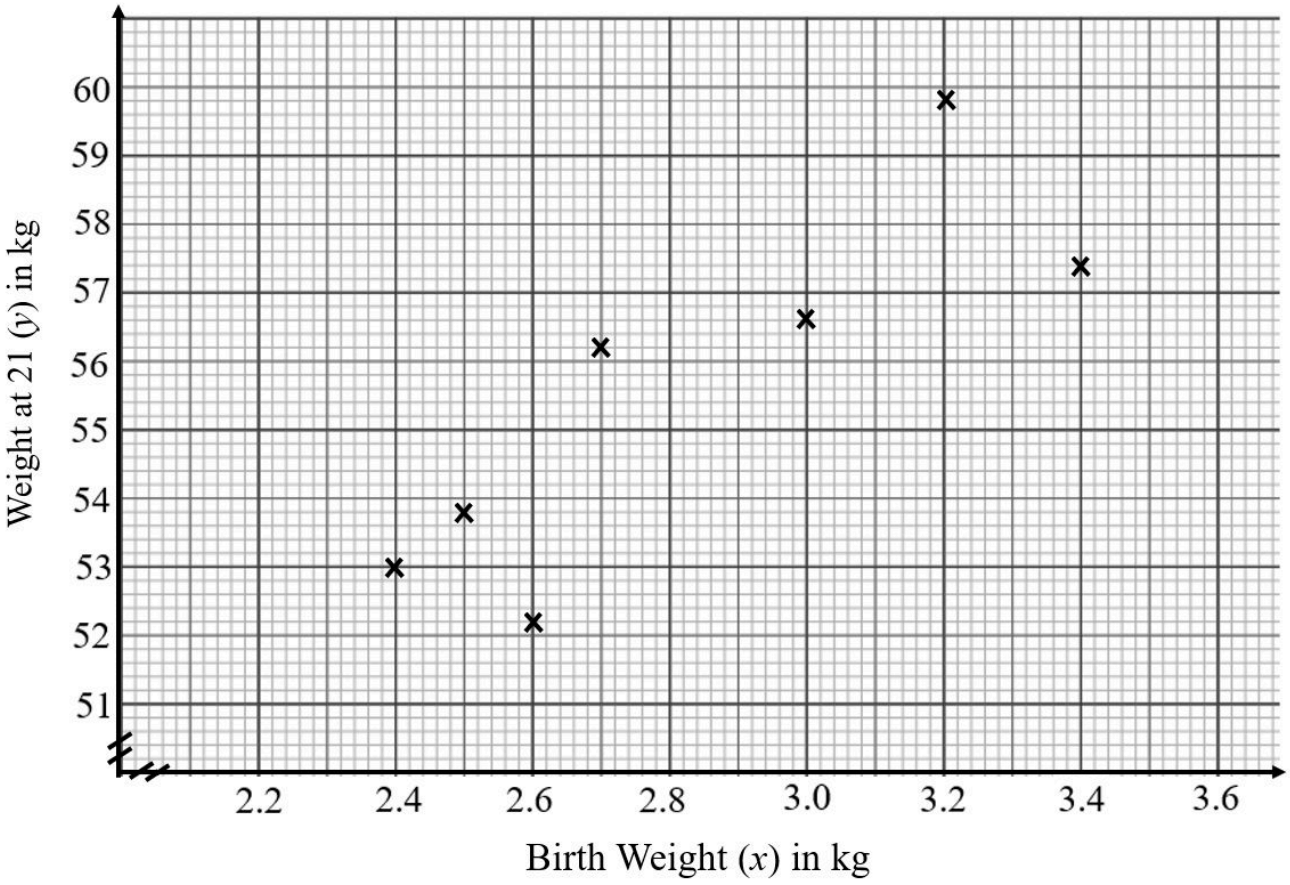
Question 24 (6 marks)

The table below shows the birth weight (x) and weight at age 21 (y) of eight women in kg.

Birth Weight (x)	2.4	2.5	2.6	2.7	3	3.2	3.4	3.5
Weight at 21 (y)	53.0	53.8	52.2	56.2	56.6	59.8	57.4	58.2



a) **Complete the scatter plot** by plotting the point that represents the **last woman in the table**. **1**

b) **Use the table** to calculate the Pearson's correlation coefficient (r) correct to 2 decimal places. **1**

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c) Use the table to find the equation of the least squares regression line with all values to 2 decimal places. **2**

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d) A baby girl was born weighing 2.9kg. Use your equation for the least squares regression line to predict her weight when she is 21 years old correct to 3 decimal places. **1**

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e) Sarah was 200g heavier than her twin sister Catherine on the day they were born. Use your equation for the least squares regression line to predict the difference in their weights when they are 21 years old. Write your answer in kg correct to 3 decimal places. **1**

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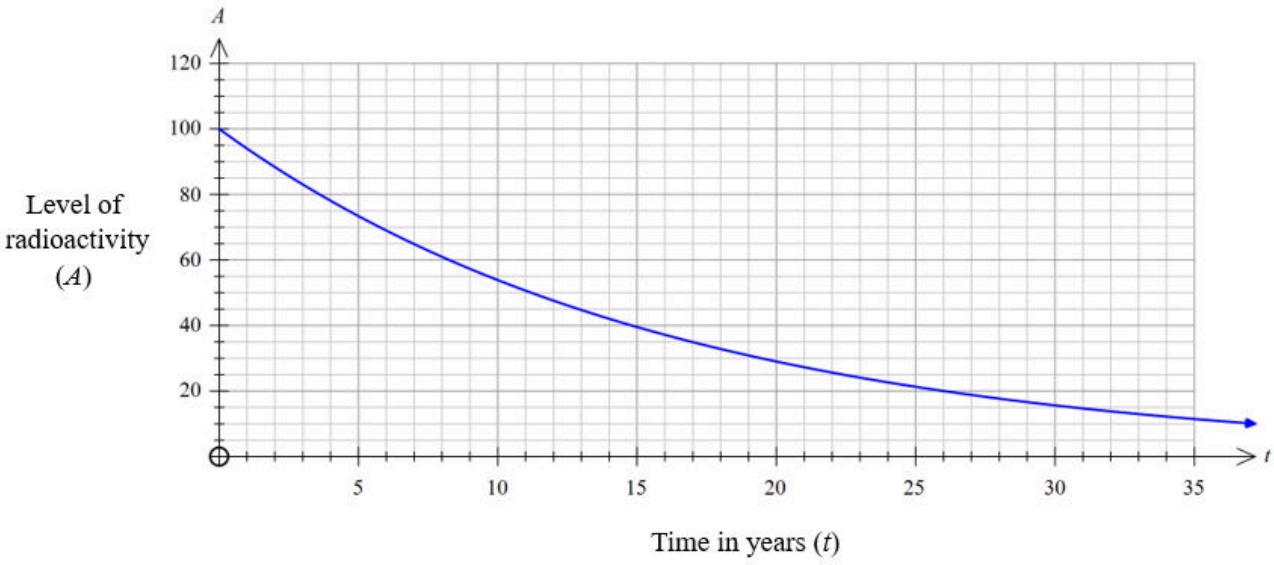
Question 25 (4 marks)

A container of radioactive waste is buried underground and the waste decays over time. After t years, its level of radioactivity $\boldsymbol{A}$ is given by the equation:

$$A = 100(0.94)^t$$

The equation has been graphed below.



a) What is the initial level of radioactivity?

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b) The 'half-life' of a radioactive substance is defined as the time taken for the radioactivity of the material to decay to half of its initial value. **Use the graph** to estimate the expected half-life of this container of radioactive waste. **1**

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c) **Calculate** the level of radioactivity A, after 50 years correct to 1 decimal place. **1**

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d) What is the percentage rate at which the radioactive waste is decaying by each year? **1**

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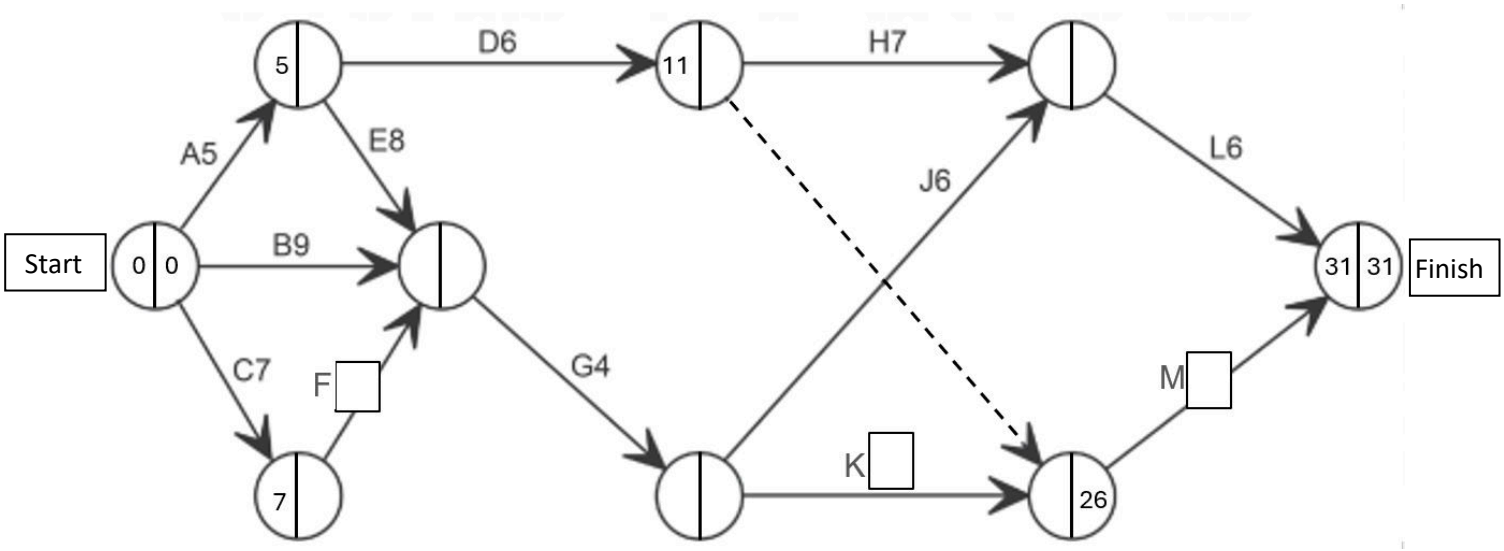
Question 26 (5 marks)

Mr Andrews is planning a bathroom renovation in his home. The network diagram below shows the required activities together with the times taken (in days).



a) Write the immediate predecessor(s) for activity M. **1**

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The critical path includes only activities A, E, G, K and M. The float time for activity F is 2 days.

b) Use the information above to complete the network diagram.

You must show

- All Earliest Start Times (EST) and Latest Start Times (LST) in the spaces provided.
- The duration in days for activities F, K and M in the spaces provided. **3**

c) What is the Latest Start Time for activity J? **1**

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END OF SECTION 3

Student's Name:_____ Teacher's Code: _____

Section 4 (20 marks)

Question 27 (3 marks)

Gavin bought a new work van **3 years ago**. It depreciates using a declining balance rate of 22% p.a. and is **now** worth $35 900.

a) What was the purchase price of the van? (2 decimal places) **2**

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b) Calculate the total depreciation in the first 3 years. **1**

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Question 28 (3 marks)

A company has 400 employees. The ratio of women to men working there is 3 : 5.
Due to some personnel restructuring, 32 new women join the company, and 16 men leave.
Find the new ratio of women to men. Write your answer in simplest form. **3**

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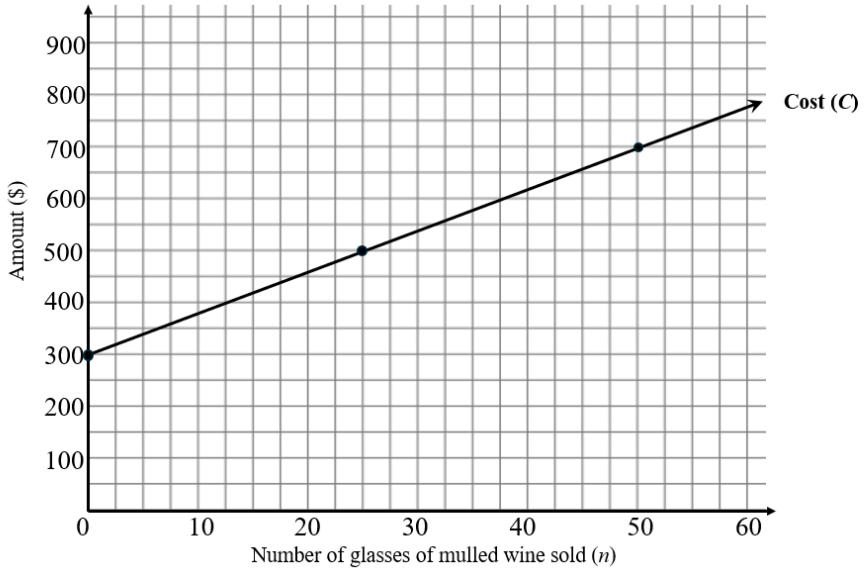
Question 29 (6 marks)

At the Bondi Winter Festival, Kate had a stall that sold Mulled Wine.

The line drawn below shows the daily costs which include hiring the stall, and producing n glasses of wine.



a) Write an equation for the line above in terms of C and n to show the cost when producing n glasses of Mulled Wine. **2**

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b) **Kate's only income** at the event is from the sale of each glass of Mulled Wine. **1**
All glasses are sold at the same price and Kate knows that she will 'break-even' when she sells 50 glasses. **Draw a line on the graph above to represent Kate's income (I).**

c) Using your line from part b or otherwise, calculate the selling price for each glass of wine. **1**

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(Question continued on the next page)

d) In one day Kate made a profit of $780.
How many glasses of Mulled Wine did she sell that day? **2**

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Question 30 (3 marks)
Frank's company manufactures children's toys. Last year the company made a profit of $360 000. He reinvests 65% of the profits into his company and distributes the rest to his shareholders as a dividend.

a) How much money is being shared out as a dividend? **1**

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b) There are 75 000 shares owned by shareholders in the company.
The current share price is $5.70.
Calculate the dividend yield correct to 2 decimal places. **2**

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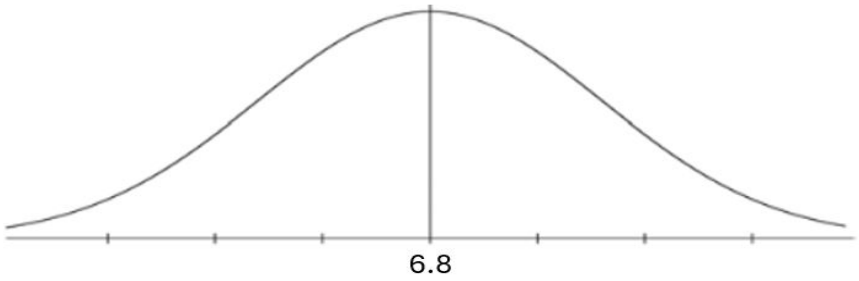
Question 31 (5 marks)

The lifespan of a particular brand of circular saw after production is normally distributed.
The circular saws have a mean life of 6.8 years and a standard deviation of 1.2 years.

a) Use this information to complete the horizontal axis in the normal distribution curve below. **1**



b) What percentage of these circular saws have a working life between 4.4 and 8 years? **1**

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The values in the table below represent the area under the normal curve to the left of the z-score.
Row labels show the z-score to one decimal place. Column labels show the second decimal place.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995

(Question continued on the next page)

c) A free replacement is provided if the circular saw lasts **less than 3.5 years** after production.
By first calculating the z-score and using the probability table provided on the previous page, estimate the number of circular saws that will be replaced out of the 40 000 that were produced at the beginning of this year. **3**

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END OF SECTION 4

Student's Name:_____ Teacher's Code: _____

Section 5 (23 marks)

Question 32 (2 marks)

The number of people (N) who attend a concert varies **inversely** with the amount of floor space (in cm^2) allowed per person (A). A venue can hold 4800 people if each person is allowed 200 cm^2.

What is the space allocation per person if 5000 people attend a concert? **2**

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Question 33 (3 marks)

Greg is driving at 54 km/h. A dog suddenly runs out into the road ahead and he applies the brakes. His **reaction time** is 1.7 seconds.

His **braking distance** is given by $D = 0.01v^2$ where v is his speed in km/h.

Calculate Greg's **stopping distance** in metres correct to 2 decimal places. **3**

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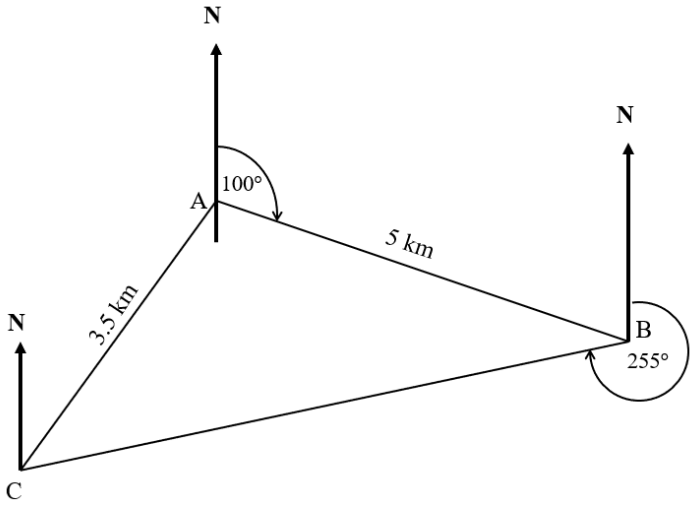
Question 34 (4 marks)

Athletes in a cross-country event start at point A and run 5km on a bearing of 100° to point B. They then turn and run on a bearing of 255° to Point C before running 3.5 km to finish at point A. The race course is shown below.

Diagram not to scale



a) Show that $\angle ABC = 25°$. **1**

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b) Find the size of $\angle ACB$ correct to the nearest degree. **2**

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c) What is the three-figure bearing of Point A from Point C? **1**

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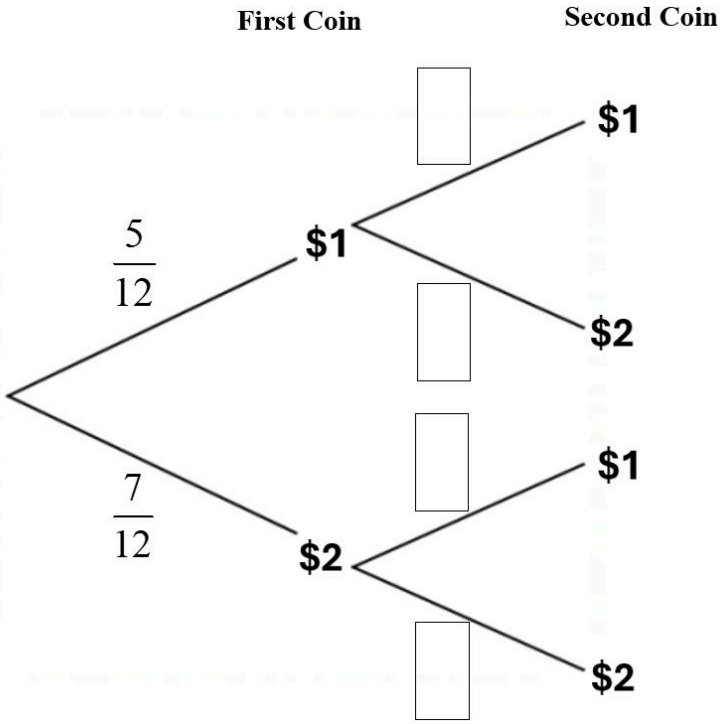
Question 35 (4 marks)

A box contains five \$1 coins and seven \$2 coins.

Henry selects one coin at random from the box and **does not replace it.**

He then takes a second coin at random from the box.



a) Complete the tree diagram by filling in the boxes to show the probability on each branch. **1**

b) Calculate the probability that Henry selects two \$2 coins. (Write your answer as a fraction) **1**

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c) Calculate the probability that Henry selects a total of **at least \$3**. **2**
(Write your answer as a fraction)

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Question 36 (5 marks)

The table below shows the future value of an annuity with a contribution of $1 at the end of each period.

Table of future value interest factors

n/r	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%
4	4.06040	4.09090	4.12161	4.15252	4.18363	4.21494	4.24646	4.27819
8	8.28567	8.43284	8.58297	8.73612	8.89234	9.05169	9.21423	9.38001
12	12.68250	13.04121	13.41209	13.79555	14.19203	14.60196	15.02581	15.46403
16	17.25786	17.93237	18.63929	19.38022	20.15688	20.97103	21.82453	22.71934
20	22.01900	23.12367	24.29737	25.54466	26.87037	28.27968	29.77808	31.37142
24	26.97346	28.63352	30.42186	32.34904	34.42647	36.66653	39.08260	41.68920
28	32.12910	34.48148	37.05121	39.85980	42.93092	46.29063	49.96758	53.99333
32	37.49407	40.68829	44.22703	48.15028	52.50276	57.33450	62.70147	68.66625

Simon wants to retire in **20 years' time.** He starts saving by depositing **$10 000** into an account at the end of every 6 months. The interest rate is 4% p.a. compounded half-yearly.

a) **Use the table** to find the total amount in Simon's account after the **first 16 years**. **2**

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After 16 years, he stops making deposits and transfers **all** of the money saved so far as a lump sum to another account. He leaves it there for the **remaining 4 years** and does not make any further contributions. This account earns interest at 6% p.a. compounding monthly.

b) Calculate the amount of money in this account at the end of the 4-year period. (2 decimal places) **2**

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c) Calculate the **total interest** that Simon has earned over the **20-year period**. (2 decimal places) **1**

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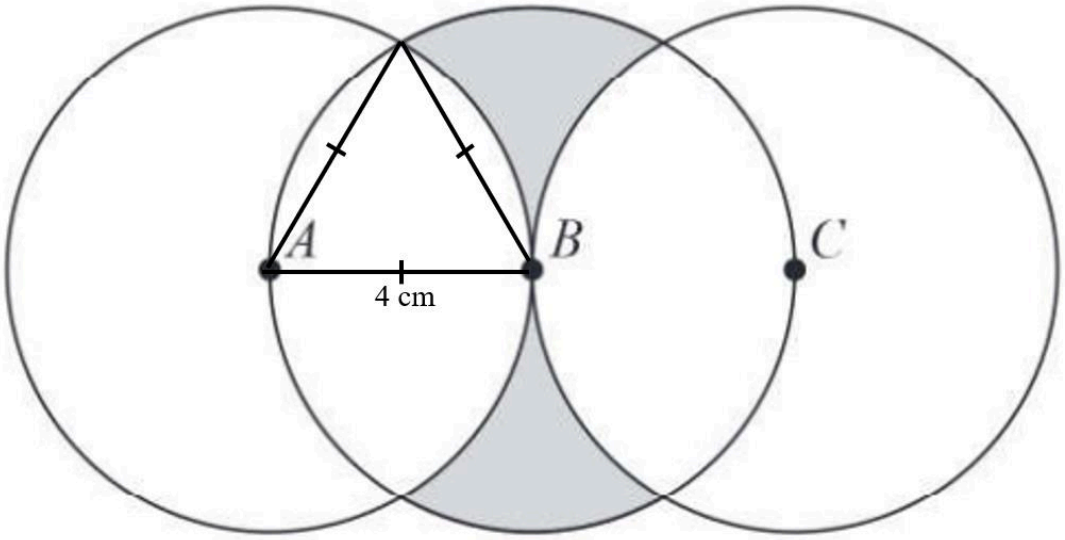
Question 37 (5 marks)

The diagram below shows 3 circles, each of **radius 4 cm**.

The centres of the circles are A, B and C such that ABC is a straight line and AB = BC = 4cm.



Calculate the **total area** of the two shaded regions correct to 2 decimal places. **5**

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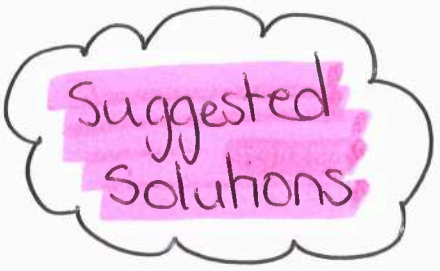
END OF SECTION 5

Student's Name:_____ Teacher's Code: _____



Saint Ignatius' College, Riverview
Mathematics Assessment Task
2024

Year 12
Mathematics Standard 2
HSC Trial Assessment Task
Date: Friday 23rd August 2024

General Instructions

- **Reading time: 10 minutes**
- **Time Allowed: 2 hours 30 minutes**
- Write using black or blue pen.
- Calculators approved by NESA may be used.
- A NESA reference sheet is provided.
- Attempt all questions in the space provided on the paper.
- Write **your name** and **your teacher's code** in the positions indicated.
- Marks may not be awarded for missing or carelessly arranged working.
- **Diagrams are not drawn to scale.**

Teachers:

- Mr A Chan AZC
- Mr D Hyde DXH
- Mrs F Yates FEY
- Ms M Kim MYK
- Dr M Furtado/ Mr G Abrahams MXF

Section 1 Multiple Choice	**15 Marks**
Section 2 Extended Response	**22 Marks**
Section 3 Extended Response	**20 Marks**
Section 4 Extended Response	**20 Marks**
Section 5 Extended Response	**23 Marks**
Total	**100 Marks**

Section 1

15 Marks

Questions 1 – 15 are multiple choice

Select the best response and shade your answer on the corresponding answer sheet provided.

Question 1

The ratio of adults to children at a Wiggles concert is 5 : 9.
How many adults are at the concert if there are 630 children?

A. 45

B. 70

C. 225

D. 350

a : c
5 : 9
x70 → 350 : 630 ← x70

Question 2

A piece of timber is measured to be 1.64 m long. The percentage error is closest to:

A. ± 0.03%

B. ± 0.3%

C. ± 3%

D. ± 30%

$\frac{0.005}{1.64} \times 100 = 0.30\%$

Question 3

A car travels 480 km on 60 L of petrol. What is its fuel consumption in L/100km?

A. 0.125 L/100 km

B. 8 L/100 km

C. 12.5 L/100 km

D. 28.8 L/100 km

480km = 60L
8 km = 1L
100 km = 12.5 L

Question 4

Scott bought a new freezer for $1800. It has an energy consumption of 488 kWh per year.

Energy is charged at a rate of $0.35/kWh.

How much will it cost to purchase and then run the freezer for 5 years?

A. $854.00

$1800 + 5(0.35 \times 488)$

B. $1970.80

$= 2654$

C. $2654.00

D. $9854.00

Question 5

The water usage charge for a non-residential property is $1.80/kL for the first 250 kL and $2.20/kL for any consumption over 250 kL. What is the cost if the amount of water consumed is 480 kL?

A. $864

$1.80 \times 250 = 450$

B. $956

$2.20 \times (480 - 250) = 506$

C. $1056

$956

D. $1506

Question 6

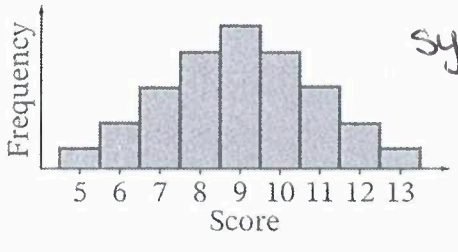
Which of the data sets below represents a distribution that is negatively skewed?

A.

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

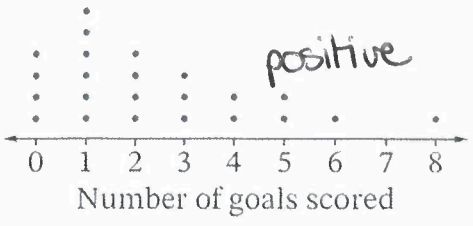
positive

B.



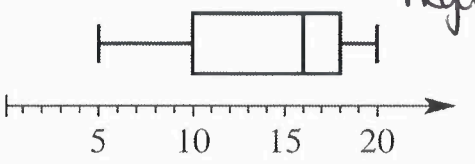
symmetrical

C.



positive

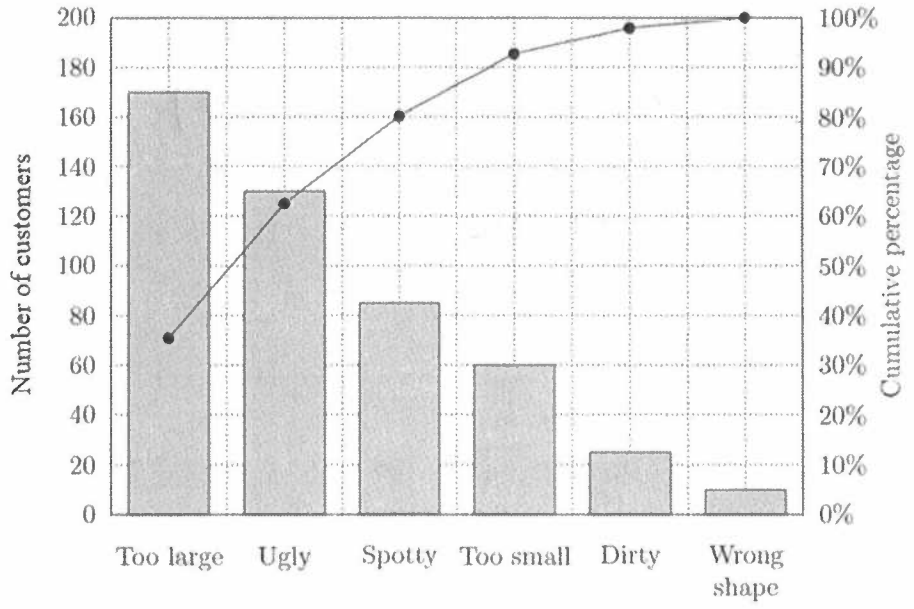
D.



negative

Question 7

The Pareto Chart below shows the reasons given by customers who returned an item purchased from an online store.



Use the chart to estimate the percentage of items that were returned for being 'Too small'.

A. 13%

93 - 80 = 13

B. 30%

C. 60%

D. 93%

Question 8

Benjamin is given 1.8 litres of fluid over 10 hours by intravenous drip.

The fluid is delivered at a rate of 30 drops per mL.

What is required drip rate, in drops per minute?

A. 15 drops/minute

1.8L = 1800 mL

B. 90 drops/minute

1800 x 30 = 54000 drops

C. 0.15 drops/minute

10 hours = 600 mins

D. 3.6 drops/minute

54000 ÷ 600 = 90 drops/min

Question 9

The table below shows the monthly repayments **per $100 000** borrowed with reducible interest.

Interest Rate (% p.a.)	Term of Loan				
	5 years	10 years	15 years	20 years	25 years
6.50	1956.61	1135.48	871.11	745.57	675.21
6.75	1968.35	1148.24	884.11	760.36	690.91
7.00	1980.12	1161.08	898.83	775.30	706.78
7.25	1991.94	1174.01	912.86	790.38	722.81
7.50	2003.79	1187.02	927.01	805.59	738.99
7.75	2015.70	1200.11	941.28	831.79	755.33

James bought an apartment for $250 000. He borrowed the amount at 7.25% p.a. interest. The loan is to be repaid monthly over 10 years. Using the table above, which value is closest to the **total amount** that James will repay?

A. $140 881.20

B. $293 502.50

C. $348 324.00

D. $352 203.00

$2.5 \times 1174.01 = 2935.025$

$2935.025 \times 10 \times 12 = 352\,203$

Question 10

A carpark contains only Black, White, Grey, Red and Blue cars.
The table below shows the relative frequency of selecting each colour of car at random.
The probability that a car selected at random is **not Grey** is 0.83.

Colour	Relative Frequency
Black	0.27
White	0.13
Grey	0.17
Red	0.31
Blue	0.12

$P(\text{Grey}) = 0.17$

If there are 500 cars in total in the car park, how many of them are **White**?

A. 65

B. 75

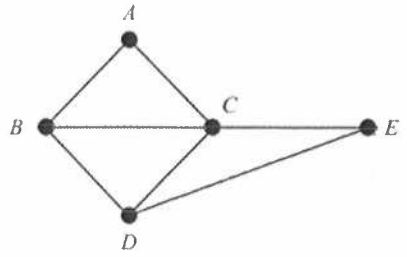
C. 85

D. 150

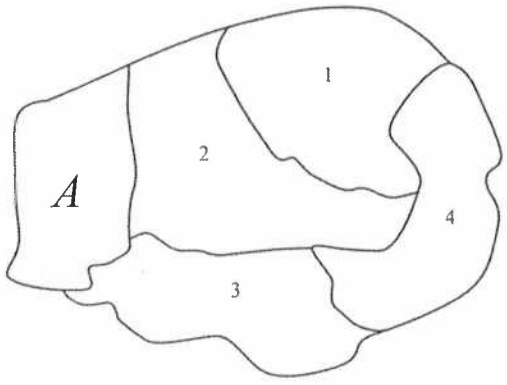
$0.13 \times 500 = 65$

Question 11

A country has five states A, B, C, D, and E. A network has been drawn below with vertices to represent each of the states. Edges represent a border shared between two states.



The diagram below shows the position of state A on a map of this country. The four other states are indicated on the diagram as 1, 2, 3 and 4.



Use this information to find the correct table that matches the state (B, C, D and E) with the corresponding number (1, 2, 3 and 4).

A.

State	State number
B	4
C	3
D	1
E	2

B.

State	State number
B	3
C	2
D	4
E	1

C.

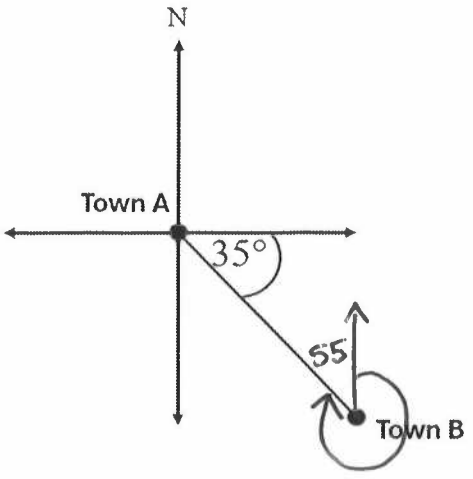
State	State number
B	2
C	3
D	4
E	1

D.

State	State number
B	3
C	2
D	1
E	4

Question 12

What is the compass bearing of Town A from Town B in the diagram below?



A. S35°E

B. S55°E

C. N35°W

D. N55°W

Question 13

The results of a recent Biology exam for Mr Smith's class are Normally Distributed with a **mean mark of 60**. His students achieved the following results.

29 44 46 49 55 55 57 61 63 65 73 74 78 91

Using the population standard deviation, how many scores have a z-score greater than 1.5?

A. 0

B. 1

C. 2

D. 3

$\sigma = 15.3$

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

$1.5 = \frac{x - 60}{15.3}$

$x = 82.95$

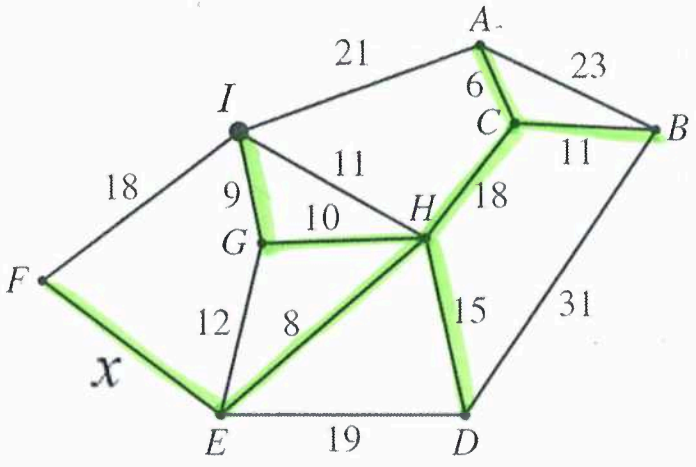
Question 14

The network below shows the distances in kilometres between 9 power substations (*A* to *I*).

The minimum length of cable required to ensure power can reach all substations is **93km**.

It is known that there will certainly be a cable connecting substations E and F.

Use this information to find the length of the cable x between E and F.



A. 12km

B. 13km

C. 16km

D. 18km

$9+10+8+15+18+6+11=77$

$93-77=16$

Question 15

There are three numbers x, y, and z and it is known that

$$y=2x$$
$$z=5y$$

Find $x:z$

A. 2 : 5

B. 5 : 2

C. 1 : 10

D. 10 : 1

let $x=1$

$y=2$

$z=10$

$1:10$

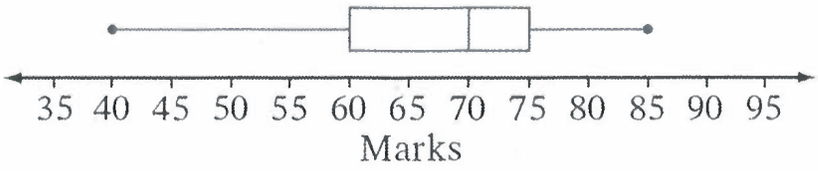
END OF SECTION 1

Student's Name:_____ Teacher's Code: _____

Section 2 (22 marks)

Question 16 (4 marks)

The dot plot below shows the results for a Year 12 History test. There are **120 students** in the course.



a) What is the median score? **1**

70 ✓

b) How many students scored at least 60 in the test? **1**

too many answered as a %

$0.75 \times 120 = 90$ ✓

c) One student was absent and completed the test the following week. **2**
He scored 95 and claims his result is an outlier.
Is he correct? Support your answer showing suitable working.

$IQR = 75 - 60$
$= 15$ ✓
$Q_3 + 1.5 \times IQR$
$75 + 1.5(15)$
$= 97.5$

well done.

$95 < 97.5$ ∴ not an outlier ✓

Question 17 (2 marks)

Finn is studying the population of rabbits in a park.
On Monday he catches a random sample of 80 rabbits, marks each rabbit with a tag and releases them back into the park. On Tuesday, he catches a random sample of 42 rabbits and 12 of them are marked with a tag. Estimate the number of rabbits in the park. **2**

$\frac{80}{x} \times \frac{12}{42}$ ✓

Well done.

$12x = 3360$
$x = 280$ ✓

Question 18 (5 marks)

a) Young's rule is used to prescribe medicine for children. The formula is shown below.

$$D = \frac{yA}{y+12}$$

D = child's dosage in mg

y = child's age in years

A = adult's dosage in mg.

What is the dosage, D, for a 3 year old child if the adult dosage is 45mg? **1**

$D = \frac{3(45)}{3+12}$ ✓

$= 9$ mg ✓

Well done.

b) Make y the subject of the formula $x = 5(y-z)$ **2**

$x = 5y - 5z$

$5y = x + 5z$ ✓

$y = \frac{x+5z}{5}$ ✓

or $\frac{x}{5} = y - z$ ✓

$y = \frac{x}{5} + z$ ✓

also paid: $y = \frac{x+5z}{5}$

c) Solve $\frac{7x-10}{3} = 4x$ **2**

$7x - 10 = 12x$ ✓

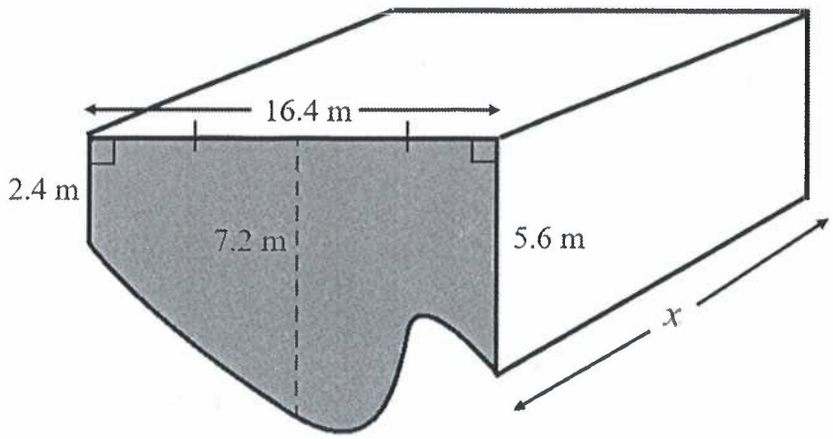
$-10 = 5x$ ✓

$x = -2$ ✓

↓ many got this last step wrong and put $-\frac{1}{2}$

Question 19 (3 marks)

The dam on Danny's property has a uniform cross-section, shaded in the diagram below.



a) Use two applications of the trapezoidal rule to show that the area of the cross-section is approximately 91.84 m^2. **2**

$h = 8.2$

Well done.

$\frac{8.2}{2}\{2.4 + 5.6 + 2(7.2)\}$ ✓

$= 91.84$ as required ✓

b) When the dam is full, it holds 2.296 Megalitres of water. **1**
What is the length of the dam (x) in metres? (Note: 1 ML = 1000 kL)

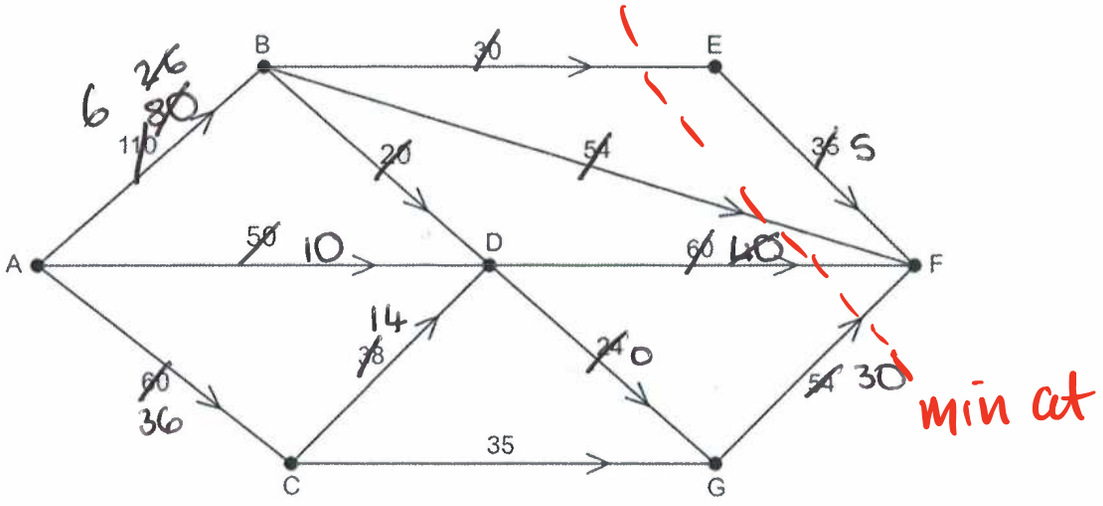
2296 kL

$2296 \div 91.84 = 25\text{m}$ ✓

Question 20 (4 marks)

A ferry service connects a group of islands in the Pacific Ocean.

The network below shows the **number of passengers** that can be carried between each island, A, B, C, D, E, F and G.



a) What is the maximum number of passengers that can be carried from A to F each hour? **2**

30 24
54 30
20
40

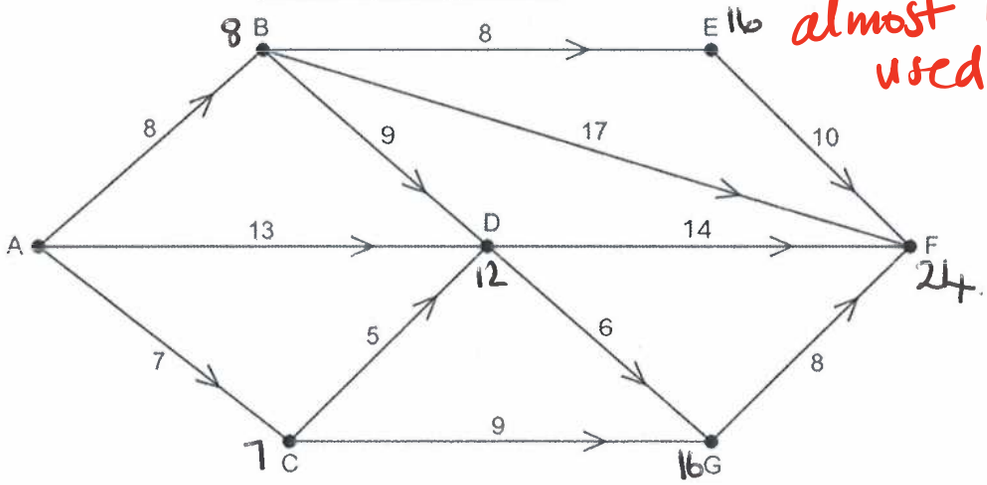
198

198 passengers ✓

(evidence of some correct working) ✓

Pretty poorly done.

b) The network below now shows the **distance in kilometers** between the islands.



almost no one used min cut.

Passengers are charged a **$12 booking fee plus $1.50 for every kilometre** they plan to travel.

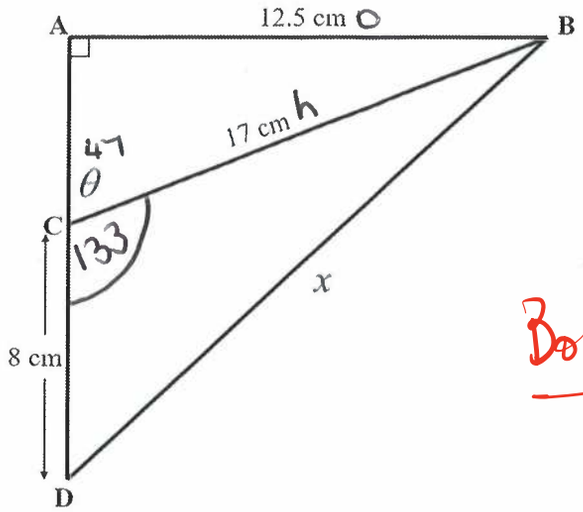
Calculate the **minimum cost** of travelling from Island A to Island F. **2**

12 + 1.50(24) = $48 ✓ ✓

Well done.

Question 21 (4 marks)

Consider the diagram below.



Both well done

a) Show that $\angle ACB = 47°$ to the nearest degree. **2**

$\sin\theta = \frac{12.5}{17}$ ✓

$\theta = 47°$ as required ✓

b) Calculate the length of side BD correct to 1 decimal place. **2**

$x^2 = 8^2 + 17^2 - 2(8)(17)\cos 133$ ✓

$x^2 = 538.5035...$

$x = 23.2$ cm ✓

END OF SECTION 2

Student's Name:_____ Teacher's Code:_____

Section 3 (20 marks)

Marker FEY

Question 22 (2 marks)

Oliver is a car salesman and earns a weekly retainer of $450 plus 4% commission on any sales.
Last week he sold only a car worth $37 000.
Calculate his total earnings for last week. 2

0·04 x 37000 = 1480 ✓

1480 + 450 = $1930 ✓

* well done !

Question 23 (3 marks)

a) When John is completing high intensity exercise, his pulse rate is 160 beats/minute and his heart pumps 28 L of blood every minute. How many millilitres of blood does John's heart pump with each beat when he is doing high intensity exercise? 1

28000mL = 160 beats

28000 ÷ 160 = 175

1beat = 175mL ✓

Remember: 1000mL = 1L

* well done

b) John burns on average 360 kilojoules (kJ) every 15 minutes when running.
John consumes a sandwich containing 1728 kJ before going on a run.
How long does he need to run to burn off the energy contained in the sandwich?
Write your answer in hours and minutes. 2

x4·8 (360 kJ = 15 mins) x4·8

1728 = 72 mins ✓

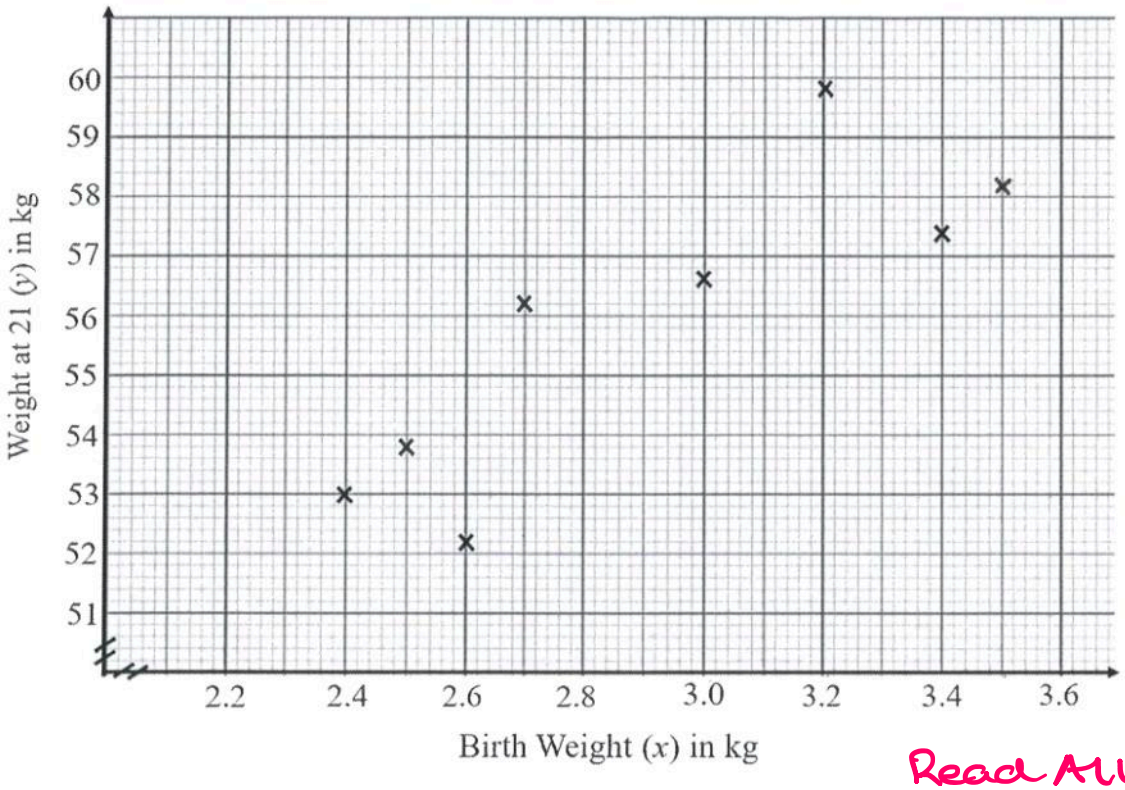
= 1 hour 12 mins ✓

* most got this !

Question 24 (6 marks)

The table below shows the birth weight (x) and weight at age 21 (y) of eight women in kg.

Birth Weight (x)	2.4	2.5	2.6	2.7	3	3.2	3.4	3.5
Weight at 21 (y)	53.0	53.8	52.2	56.2	56.6	59.8	57.4	58.2



Read All Qus!

a) **Complete the scatter plot** by plotting the point that represents the **last woman in the table.** 1

* some student didn't do this ???

b) **Use the table** to calculate the Pearson's correlation coefficient (r) correct to 2 decimal places. 1

$r = 0.85$ good ✓

c) Use the table to find the equation of the least squares regression line with all values to 2 decimal places. 2

$y = 5.37x + 40.25$ ✓✓

* some clearly didn't revise & learn calculator steps!

Must learn this! Easy marks!!

d) A baby girl was born weighing 2.9kg. Use your equation for the least squares regression line to predict her weight when she is 21 years old correct to 3 decimal places. **1**

$y = 5.37(2.9) + 40.25$
$= 55.823$ kg ✓

* easy for those who had answered c)

Learn how to do c) !!

e) Sarah was 200g heavier than her twin sister Catherine on the day they were born. Use your equation for the least squares regression line to predict the difference in their weights when they are 21 years old. Write your answer in kg correct to 3 decimal places. **1**

$5.37(0.2) = 1.074$ kg ✓

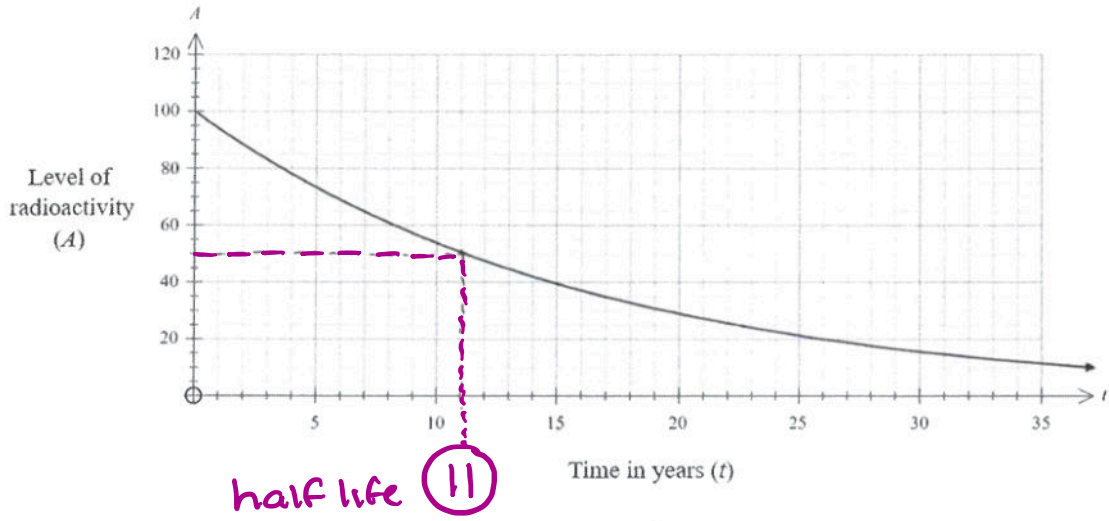
* Well done!

Question 25 (4 marks)

A container of radioactive waste is buried underground and the waste decays over time. After t years, its level of radioactivity A is given by the equation:

$$A = 100(0.94)^t$$

The equation has been graphed below.



a) What is the initial level of radioactivity? 1

100 ✓

b) The 'half-life' of a radioactive substance is defined as the time taken for the radioactivity of the material to decay to half of its initial value. **Use the graph** to estimate the expected half-life of this container of radioactive waste. 1

11 years ✓

* v. generous here!!

* students should be showing this clearly on graph!

c) **Calculate** the level of radioactivity A, after 50 years correct to 1 decimal place. 1

$A = 100(0.94)^{50}$

$A = 4.5$ ✓

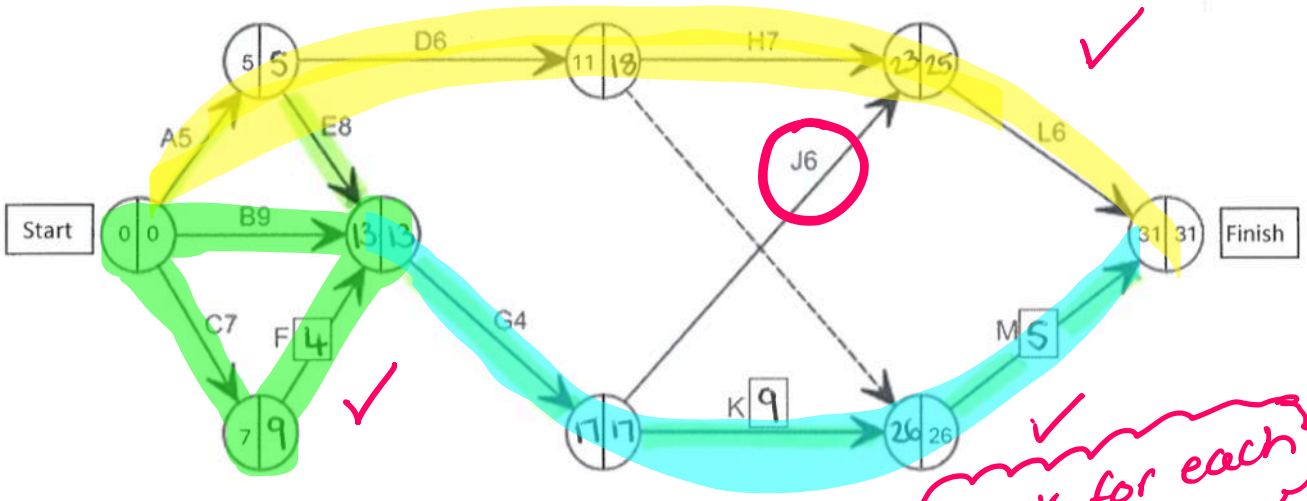
d) What is the percentage rate at which the radioactive waste is decaying by each year? 1

6% ✓

* a few students wrote 94% learn - decay! 1 − 0.94

Question 26 (5 marks)

Mr Andrews is planning a bathroom renovation in his home. The network diagram below shows the required activities together with the times taken (in days).



a) Write the immediate predecessor(s) for activity M. **1**

D and K

The critical path includes only activities A, E, G, K and M.

The float time for activity F is 2 days.

b) Use the information above to complete the network diagram.

13 − 7 − x = 2

x = 4

You must show

- All Earliest Start Times (EST) and Latest Start Times (LST) in the spaces provided.
- The duration in days for activities F, K and M in the spaces provided. **3**

c) What is the Latest Start Time for activity J? **1**

Float time = 2 days 17 + 2 = 19

19 days

END OF SECTION 3

Student's Name:_____ Teacher's Code: _____

Section 4 (20 marks)

Question 27 (3 marks)

Gavin bought a new work van **3 years ago**. It depreciates using a declining balance rate of 22% p.a. and is **now** worth $35 900.

a) What was the purchase price of the van? (2 decimal places) **2**

$V = S_0(1-r)^n$

$35900 = S_0(1-0.22)^3$ ✓

$\frac{35900}{(1-0.22)^3} = \frac{S_0(1-0.22)^3}{(1-0.22)^3}$

$\$75650.30 = S_0$ ✓

- generally well done
- some students wrote $(1+0.22)^3$

b) Calculate the total depreciation in the first 3 years. **1**

$= 75650.30 - 35900$

$= \$39750.30$ ✓

- well done
- ECF if (a) was wrong but showed working

Question 28 (3 marks)

A company has 400 employees. The ratio of women to men working there is 3 : 5.
Due to some personnel restructuring, 32 new women join the company, and 16 men leave.
Find the new ratio of women to men. Write your answer in simplest form. **3**

W : M

3 : 5 → 8 parts = 400

150 : 250 ✓ → 1 part = 50

+32 −16

182 : 234 ✓

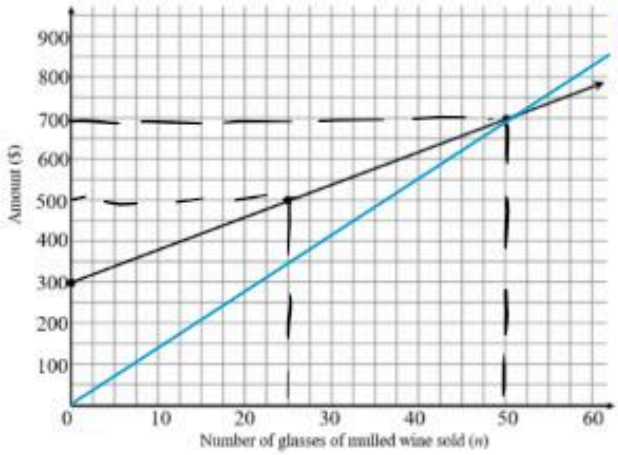
7 : 9 ✓

- generally well done
- some didn't fully simplify OR flipped the ratio e.g. 9 : 7

Question 29 (6 marks)

At the Bondi Winter Festival, Kate had a stall that sold Mulled Wine.

The line drawn below shows the daily costs which include hiring the stall, and producing n glasses of wine.



a) Write an equation for the line above in terms of C and n to show the cost when producing n glasses of Mulled Wine. **2**

$y = mx + c$

$m = \frac{700-500}{50-25}$

$= 8$

$y = 8x + 300$

$\therefore C = 8n + 300$ ✓ ✓

- make sure to write using 'C' and 'n'

b) **Kate's only income** at the event is from the sale of each glass of Mulled Wine. **1**

All glasses are sold at the same price and Kate knows that she will 'break-even' when she sells 50 glasses. **Draw a line on the graph above to represent Kate's income (I).**

- generally well done

c) Using your line from part b or otherwise, calculate the selling price for each glass of wine. **1**

$\text{Selling price} = \frac{\$700}{50 \text{ glasses}}$

$= \$14$

- generally well done
- no need to find the equation of the income line

(Question continued on the next page)

d) In one day Kate made a profit of $780.
How many glasses of Mulled Wine did she sell that day? 2

Profit = income − cost
= 14n − (8n + 300)
780 = 6n − 300 ✓
1080 = 6n
∴ n = 180 glasses ✓

- poorly done
- important to remember that: Profit = income − cost
- ECF if wrong answer for (a) and (c)

Question 30 (3 marks)
Frank's company manufactures children's toys. Last year the company made a profit of $360 000. He reinvests 65% of the profits into his company and distributes the rest to his shareholders as a dividend.

a) How much money is being shared out as a dividend? 1

35% × 360 000 = $126 000 ✓

- generally well done

ECF

b) There are 75 000 shares owned by shareholders in the company.
The current share price is $5.70.
Calculate the dividend yield correct to 2 decimal places. 2

= $126 000 ÷ 75 000 shares
= $1.68 per share ✓

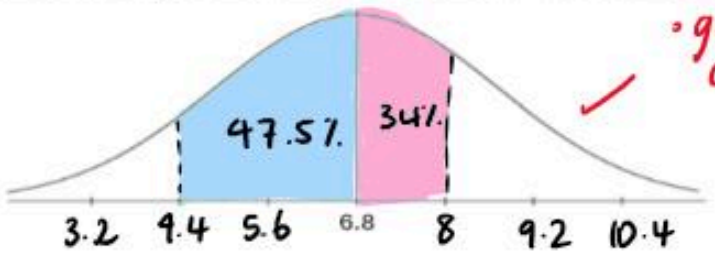
- poorly done
- dividend yield is answered as a %.

dividend yield = $\frac{1.68}{5.70} \times 100$
= 29.47% (2 d.p.) ✓

Question 31 (5 marks)

The lifespan of a particular brand of circular saw after production is normally distributed.
The circular saws have a mean life of 6.8 years and a standard deviation of 1.2 years.

a) Use this information to complete the horizontal axis in the normal distribution curve below. **1**



• generally well done

b) What percentage of these circular saws have a working life between 4.4 and 8 years? **1**

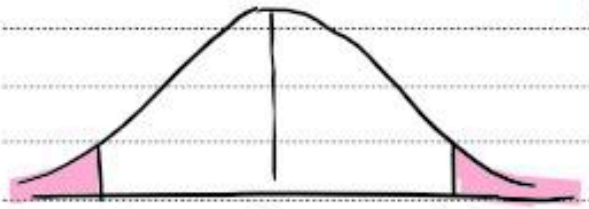
81.5 % ✓ • generally well done.

The values in the table below represent the area under the normal curve to the left of the z-score.
Row labels show the z-score to one decimal place. Column labels show the second decimal place.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995

(Question continued on the next page)

c) A free replacement is provided if the circular saw lasts **less than 3.5 years** after production. **By first calculating the z-score** and using the probability table provided on the previous page, estimate the number of circular saws that will be replaced out of the 40 000 that were produced at the beginning of this year. **3**



- generally poorly done
- ECF if wrong z-score, but subsequent working out and answer was "correct"

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

$= \frac{3.5-6.8}{1.2}$

$= -2.75$ ✓

$P(z < -2.75)$

$= 1 - P(z > 2.75)$

$= 1 - 0.9970$

$= 0.003$ ✓

$\therefore 0.003 \times 40\,000$

$= 120$ saws will be replaced ✓

END OF SECTION 4

Student's Name:_____ Teacher's Code: _____

Section 5 (23 marks)

Question 32 (2 marks)

The number of people (N) who attend a concert varies **inversely** with the amount of floor space (in cm^2) allowed per person (A). A venue can hold 4800 people if each person is allowed 200 cm^2.

What is the space allocation per person if 5000 people attend a concert? **2**

$N = \frac{k}{A}$

$4800 = \frac{k}{200}$

$k = 960000$

$N = \frac{960000}{A}$ ✓

$5000 = \frac{960000}{A}$

$A = 192\ m^2$ ✓

Question 33 (3 marks)

Well done most got this right.

Greg is driving at 54 km/h. A dog suddenly runs out into the road ahead and he applies the brakes. His **reaction time** is 1.7 seconds.

His **braking distance** is given by $D = 0.01v^2$ where v is his speed in km/h.

Calculate Greg's **stopping distance** in metres correct to 1 decimal places. **3**

54 km/h = 54000 m/h

= 15 m/s

15 x 1.7 = 25.5m (reaction distance) ✓ Good

$0.01(54)^2 = 29.16$m (braking distance) ✓ Good

Total = 25.5 + 2916

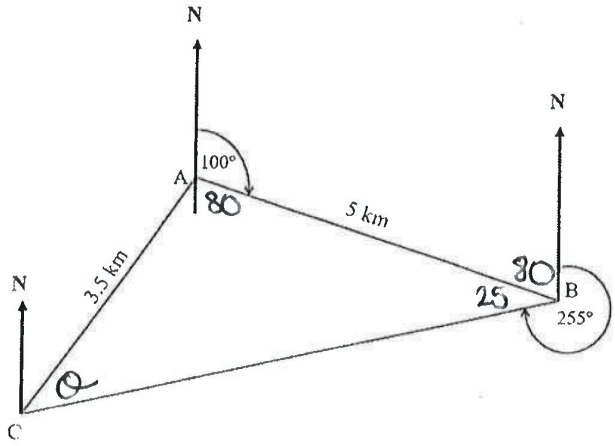
= 54.66 m ✓

Some mistakes here.

Question 34 (4 marks)

Athletes in a cross-country event start at point A and run 5km on a bearing of 100° to point B. They then turn and run on a bearing of 255° to Point C before running 3.5 km to finish at point A. The race course is shown below.

Diagram not to scale



a) Show that $\angle ABC = 25°$. **1**

$360 - 80 - 255$

$= 25°$ ✓

As usual 25° is produced without any logic!

b) Find the size of $\angle ACB$ correct to the nearest degree. **2**

$\frac{3.5}{\sin 25} = \frac{5}{\sin\theta}$ ✓

use of formula!

$\sin\theta = \frac{5\sin 25}{3.5}$

$\sin\theta = 0.6037$

$\theta = 37°$ ✓

c) What is the three-figure bearing of Point A from Point C? **1**

$180 - 37 - 80 - 25 = 38$

Very few got this answer.

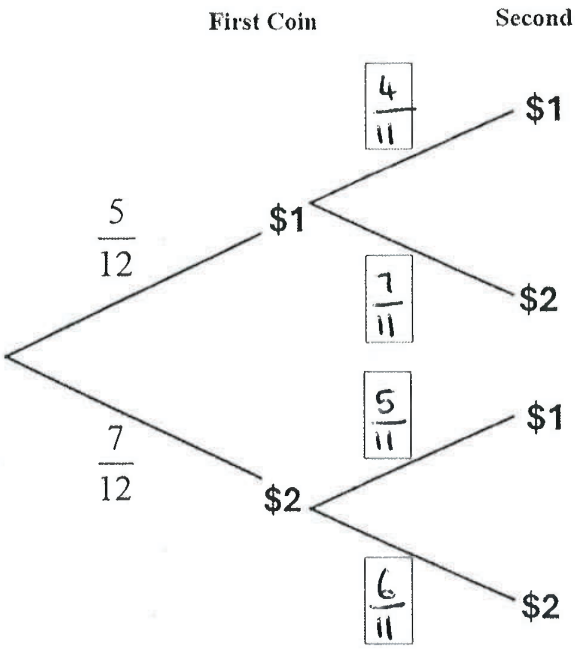
038° ✓ (using alternate angles)

Question 35 (4 marks)

A box contains five \$1 coins and seven \$2 coins.

Henry selects one coin at random from the box and **does not replace it.**

He then takes a second coin at random from the box.



Well done.

a) Complete the tree diagram by filling in the boxes to show the probability on each branch. **1**

b) Calculate the probability that Henry selects two \$2 coins. (Write your answer as a fraction) **1**

$\frac{7}{12} \times \frac{6}{11} = \frac{7}{22}$ ✓ Well done.

c) Calculate the probability that Henry selects a total of **at least \$3**. **2**
(Write your answer as a fraction)

1 - P(two \$1)

$1 - \left(\frac{5}{12} \times \frac{4}{11}\right)$ ✓

$= \frac{28}{33}$ ✓

OR

\$1 and \$2 $\left(\frac{5}{12} \times \frac{7}{11}\right) = \frac{35}{132}$

\$2 and \$1 $\left(\frac{7}{12} \times \frac{5}{11}\right) = \frac{35}{132}$

\$2 and \$2 $\left(\frac{7}{12} \times \frac{6}{11}\right) = \frac{7}{22}$

$\frac{28}{33}$

Its atleast \$3 ∴ \$4 included.

Question 36 (5 marks)

The table below shows the future value of an annuity with a contribution of \$1 at the end of each period.

Table of future value interest factors

n/r	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%
4	4.06040	4.09090	4.12161	4.15252	4.18363	4.21494	4.24646	4.27819
8	8.28567	8.43284	8.58297	8.73612	8.89234	9.05169	9.21423	9.38001
12	12.68250	13.04121	13.41209	13.79555	14.19203	14.60196	15.02581	15.46403
16	17.25786	17.93237	18.63929	19.38022	20.15688	20.97103	21.82453	22.71934
20	22.01900	23.12367	24.29737	25.54466	26.87037	28.27968	29.77808	31.37142
24	26.97346	28.63352	30.42186	32.34904	34.42647	36.66653	39.08260	41.68920
28	32.12910	34.48148	37.05121	39.85980	42.93092	46.29063	49.96758	53.99333
32	37.49407	40.68829	44.22703	48.15028	52.50276	57.33450	62.70147	68.66625

Simon wants to retire in **20 years' time.** He starts saving by depositing **\$10 000** into an account at the end of every 6 months. The interest rate is 4% p.a. compounded half-yearly.

a) **Use the table** to find the total amount in Simon's account after the **first 16 years.** 2

2% 10000 x 44.22703 ✓ Several errors here.
32 periods = \$442270.30 ✓ 1. Some used 4%.
2. Some used 16 as period

After 16 years, he stops making deposits and transfers **all** of the money saved so far as a lump sum to another account. He leaves it there for the **remaining 4 years** and does not make any further contributions. This account earns interest at 6% p.a. compounding monthly.

b) Calculate the amount of money in this account at the end of the 4-year period. (2 decimal places) 2

$442270.30\left(1+\frac{0.06}{12}\right)^{48} = 561899.62$ ✓ ✓

Here too: Interest comp. monthly $\frac{6\%}{12}$
term: 4×12

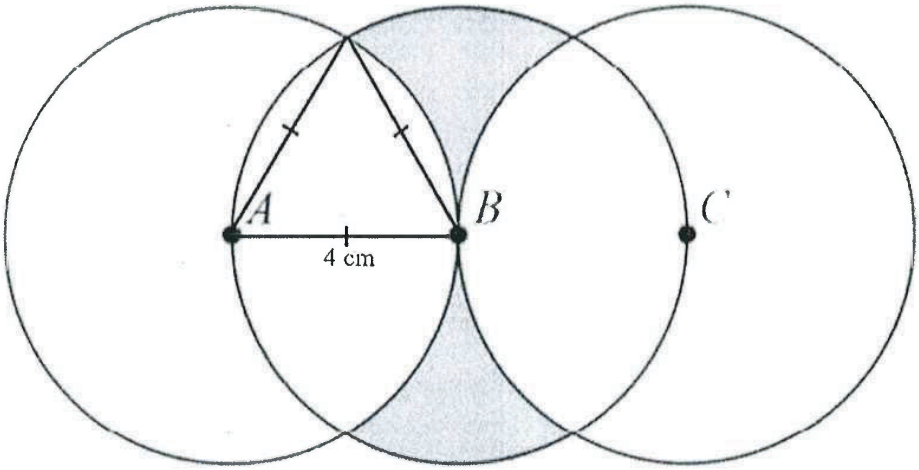
c) Calculate the **total interest** that Simon has earned over the **20-year period.** (2 decimal places) 1

561899.62 − (32 × 10000) Here the Contribution is 32 × 10,000 Not 10,000
= \$241899.62 ✓

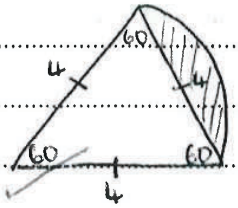
Question 37 (5 marks)

The diagram below shows 3 circles, each of **radius 4 cm**.

The centres of the circles are A, B and C such that ABC is a straight line and AB = BC = 4cm.



Calculate the **total area** of the two shaded regions correct to 2 decimal places. **5**



Area of a triangle $= \frac{1}{2}(4)(4)\sin 60$

$= 6.9282$ ✓

Area of a sector $= \frac{1}{6} \times \pi \times 4^2$

$= 8.37758$ ✓

1 mark for evidence of 60°

Area of shaded segment $= 8.37758 - 6.9282$

$= 1.4494$ ✓

Sector − 2 segments $= 8.37758 - 2(1.4494)$

$= 5.47878$

Total area $= 5.47878 \times 2$

$= 10.96 cm^2$ ✓

Just a handful got this question right.