Student Number

12MAS – Miss Bannon

Caringbah High School

2023 HIGHER SCHOOL CERTIFICATE TRIAL EXAMINATION

Mathematics Standard 2

General Instructions

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

Total marks: 100

Section I – 15 marks (pages 2–5)

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

Section II – 85 marks (pages 7–23)

- Attempt Questions 16–39
- Allow about 2 hours and 5 minutes for this section

Section I	Section II	Total
/15	/85	/100

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 0.004083 expressed in scientific notation with two significant figures?

A. 4.1×10^{-2}

B. 4.08×10^{-3}

C. 4.1×10^{-3}

D. 4.08×10^{-2}

2. Cornflour is sold in four different sized packets. Which is the best buy?

A. 1kg for $4.00
B. 2kg for $7.90
C. 100 g for $0.45
D. 500 g for $1.90

3. A rock is measured to be 0.8cm in length, correct to one decimal place.
What is the percentage error in this measurement?

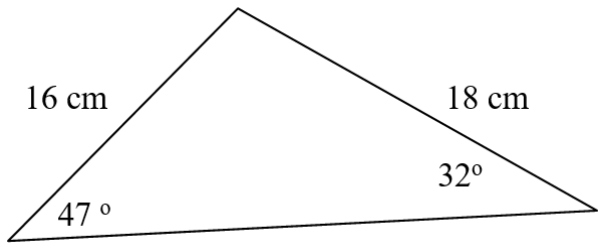
A. ± 0.125%

B. ± 0.625%

C. ± 12.5%

D. ± 6.25%

4. What is the area of the triangle shown below? Correct to the nearest whole number.



A. 141 cm^2

B. 76 cm^2

C. 280 cm^2

D. 110 cm^2

5. Which car insurance covers injuries to the driver at fault and to any other people, but does not cover damage to cars or other property?

A. Comprehensive
B. Compulsory Third Party
C. Comprehensive Fire and Theft
D. Third Party Property

6. Jo owns a machine that is initially worth $\$500\ 000$ and which depreciates at a rate of 18% per year using the declining balance method.

How much will it depreciate in the third year?

A. $60 516
B. $73 800
C. $275 684
D. $336 200

7. A homeowner borrows $155 000. Interest is charged on the balance owing at a rate of 0.6% per month. A repayment of $1200 is made at the end of each month.

What is the balance of the loan after the repayment at the end of the second month?

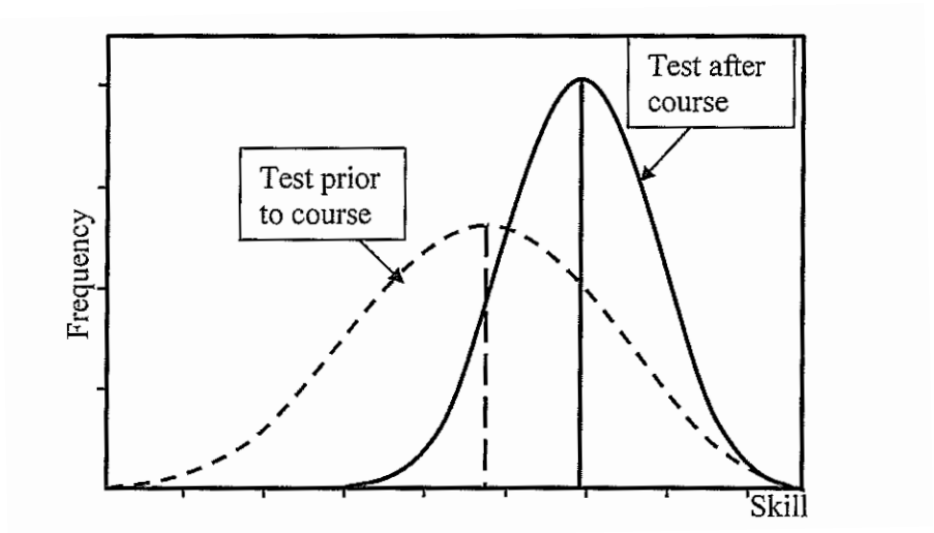
A. $154 458.38
B. $154 185.13
C. $153 910.24
D. $153 633.70

8. Expand and simplify $3x^2 - 10xy - 4x(2y - 3x)$

A. $15x^2 - 18xy$
B. $-9x^2 - 18xy$
C. $15x^2 - 2xy$
D. $-9x^2 - 2xy$

9. To determine the effectiveness of a training course, students undertook a skill test prior to the course and another test after they completed the training course.

The data collected is displayed in the graphs below.



Compared to the "prior test" data, the "after test" data has which of the following?

A. A higher mean and smaller standard deviation
B. A higher mean and a larger standard deviation
C. A lower mean and a smaller standard deviation
D. A lower mean and a larger standard deviation

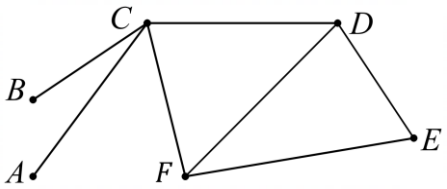
10. The following table shows the monthly repayments on a personal loan.

	Rate of Interest		
Amount Borrowed	5%	6%	7%
$	$	$	$
5 000	126	89	79
10 000	252	177	158
15000	377	266	237
20 000	503	354	315

The total interest paid on a loan of $10 000 over 20 years at 6% p.a. is:

A. $2124
B. $3540
C. $32 480
D. $42 280

11. A network graph is shown below.



How many edges will a spanning tree of this network have?

A. 5
B. 6
C. 7
D. 8

12. A new colour of paint is made using a mixture of red, yellow and white paint in the ratio 2 : 3 : 6. If the new paint comes in two-litre tins, how much yellow paint (to the nearest mL) is needed in each two-litre tin?

A. 364 mL
B. 545 mL
C. 667 mL
D. 1091 mL

13. Leo boards a plane in London at 6 pm on Wednesday 10th September and flies for 22 hours before arriving in Sydney. Given that Sydney's time zone is ten hours ahead of London's, what is the local time when he arrives in Sydney?

A. 6:00am Friday 12th
B. 2:00am Friday 12th
C. 6:00am Thursday 11th
D. 2:00am Thursday 11th

14. Blood alcohol for a female can be estimated using the following BAC formula

$$\text{BAC}_{\text{Female}} = \frac{10N - 7.5H}{5.5M},$$

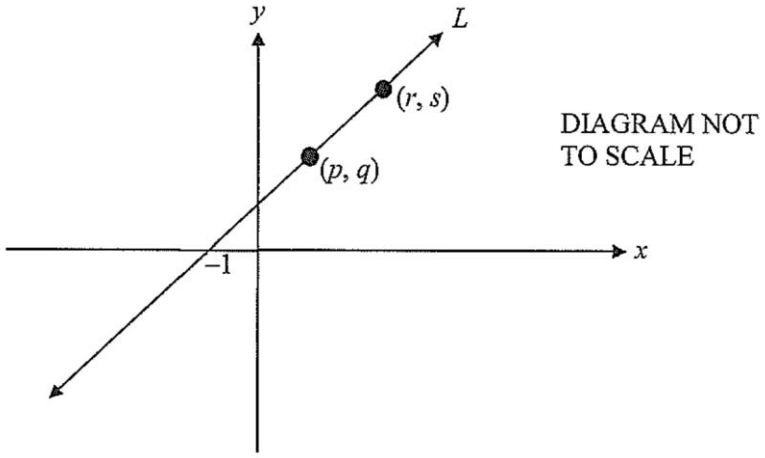
where N is the number of standard drinks consumed, H is the number of hours since they started drinking and M is the person's mass in kilograms.

Georgie weighs 58 kg and had a BAC of 0.08 after drinking for 2 hours.

Approximately, how many standard drinks did she have?

A. 2
B. 3
C. 4
D. 5

15. The line L passes through the points $(-1, 0)$, (p, q) and (r, s).



If $r = p + 3$ and $s = q + 9$, what is the equation of the line L?

A. $y = 2x + 1$
B. $y = 2x + 2$
C. $y = 3x + 3$
D. $y = 3x + 4$

End of Section 1

Mathematics Standard 2

Student Number

Section II

Section II

85 marks
Attempt Questions 16–39
Allow about 2 hours and 5 minutes for this section

Instructions

- Write your Student Number at the top of this page.
- 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 on pages 24-25. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 16 (2 marks)

On a map of NSW, the distance between Tweed Heads and Bega is 131 mm.

The scale of the map is 1: 10 000 000.

What is the actual distance between Tweed Heads and Bega in kilometres?

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Question 17 (2 marks)

Cooper is moving out of home into a new unit and needs to work out a budget. For washing clothes, he needs to buy a washing machine and clothes dryer, and allow for the first two year's electricity usage.

- The washing machine costs $479 and is estimated to use 426 kWh per year.
- The clothes dryer costs $349 and is estimated to use 202 kWh per year.
- Electricity is charged at 27.799 cents per kWh.

Find the total cost of purchasing the washing machine and clothes dryer and running them for two years. **2**

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Question 18 (2 marks)

A bank charges 0.0603% interest per day on the amount owing on a credit card.

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What is the interest charged in three weeks on a balance of $1500?

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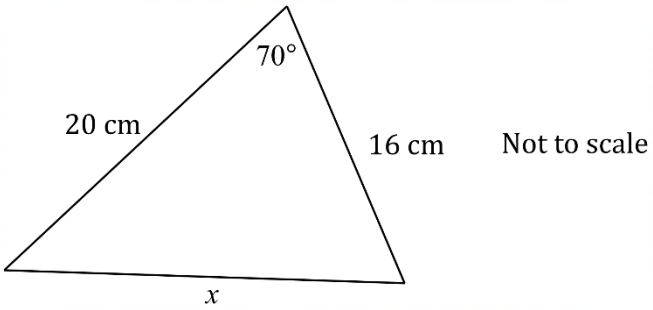
Question 19 (2 marks)

Use the cosine rule to find the value of x, correct to two decimal places. **2**



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Question 20 (3 marks)

The number of non-native plants growing on an island is modelled by the equation:

$$N = 2000(1.025)^t$$

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

(a) What is the annual percentage rate of increase in the number of plants based on this model? **1**

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(b) By the end of the year 2030, what is an estimate for the increase in the number of plants growing on the island since 2015? **2**

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Question 21 (2 marks)

The speed (v), in km/h, of a truck is inversely proportional to the weight (w kg) it carries. A truck carrying a weight of 1600 kg can travel at 80 km/h. What is the speed of the truck if the weight is 1250 kg ? **2**

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Question 22 (3 marks)

A parent used Young's formula to calculate the required medication dosage for their child.

Young's formula is

$$\text{Dosage} = \frac{\text{Age of child (years)} \times \text{Adult dose}}{\text{Age of child (years)} + 12}.$$

They found that the child's dosage was one third of the adult dose. **3**

How old is the child?

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Question 23 (5 marks)

Charlie earns a gross amount of $900 per week. He then pays union fees of $15 each week which are tax deductable.

Taxable income	*Tax on this income*
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5c for each $1 over $37 000
$90 001 – $180 000	$20 797 plus 37c for each $1 over $90 000
$180 001 and over	$54 097 plus 45c for each $1 over $180 000

(a) Using the tax table above, calculate Charlies tax payable, including a Medicare levy of 2% of his taxable income. **3**

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(b) Charlie's boss took out $157 each week as PAYG tax. At the end of the financial year, will Charlie receive a tax refund or will he owe more tax? How much? **2**

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Question 24 (2 marks)

A dishwasher has a price of $799. Mr Clean agreed to buy it, making a deposit of $150 and monthly repayments of $35 over two years.

What is the flat rate of interest p.a. , correct to one decimal place, being charged on the balance? **2**

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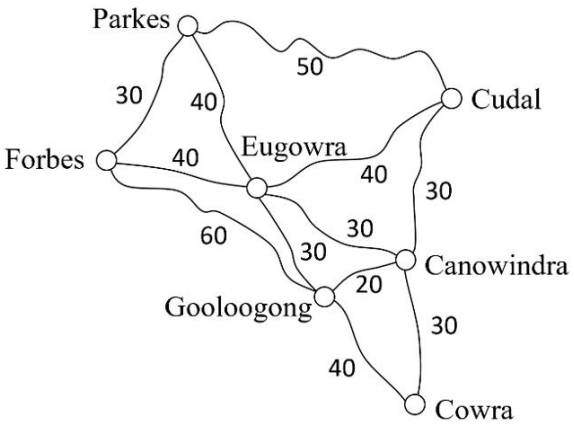
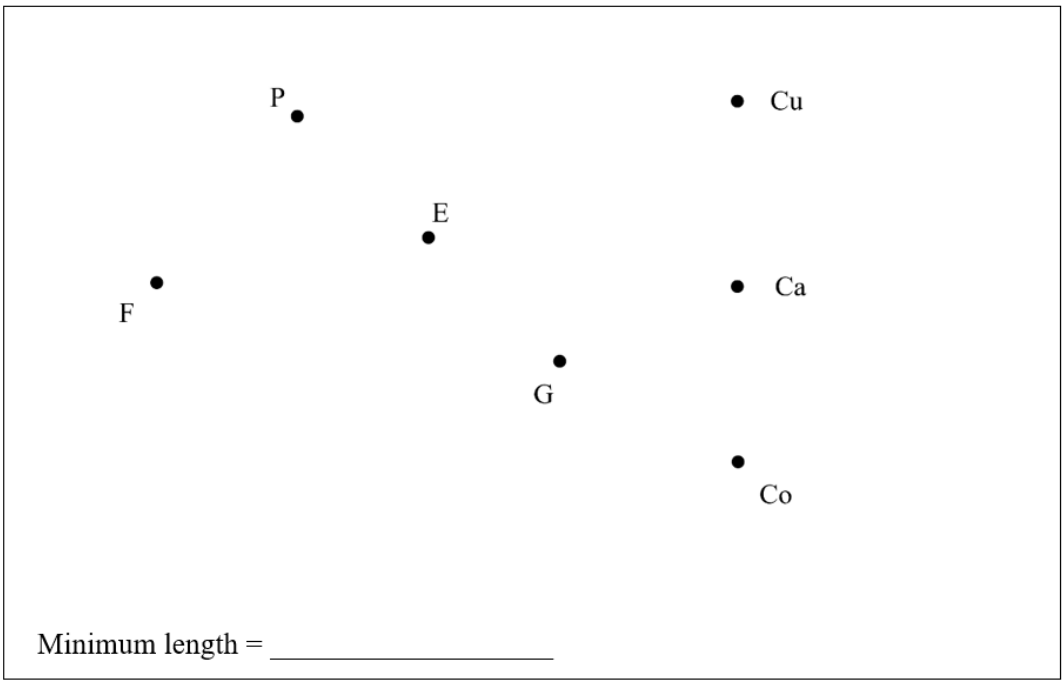
Question 25 (2 marks)

The road map shows the roads connecting 7 towns. The numbers represent the distances along the roads between the towns, in kilometres.



By drawing a minimum spanning tree in the space below, calculate the minimum length of pipes required to supply water to all towns if the water pipes can only be laid along the roads. **2**



Question 26 (4 marks)

45% of the residents in a local community have been administered only one vaccination against a spreading virus and 30% of the residents have been administered two vaccinations (so that they are fully vaccinated).

(a) What is the probability that a randomly chosen resident from the community has NOT been administered at least ONE vaccination?

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(b) What is the probability that a randomly chosen resident from the community has been administered at least ONE vaccination?

…… **1**

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(c) If TWO residents are randomly selected from the community, what is the probability that at least ONE of them has been administered at least ONE vaccination?

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Please turn over…

Question 27 (4 marks)

The table below shows the present value of a $1 annuity.

Number of periods	*Interest rate per period as a decimal*				
	0.001	0.00125	0.0015	0.00175	0.002
300	259.0707	250.0398	241.4379	233.2418	226.3477
330	280.9577	270.2690	260.1353	250.5239	240.7211
360	302.1982	289.7541	278.0106	266.9228	258.9154
390	325.2961	309.6290	297.0981	283.6291	261.9432

(a) What would be the present value of a $2000 per month annuity at 1.2% per annum for 25 years, with interest compounding monthly? **2**

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(b) Thomas borrowed $600 000 to purchase a home, with interest charged at 1.5% per annum compounding monthly. He agrees to repay the loan by making equal monthly payments over a 30-year period. **2**

What is the monthly payment ? Answer correct to the nearest cent.

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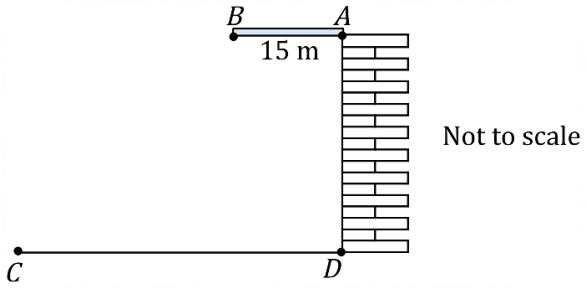
Question 28 (5 marks)

A 15 m platform (*AB*) extends from the top of one side of a building as shown in the diagram below. Point *C*, at ground level, is measured to be at angles of depression of 42° and 60° from points *A* and *B* respectively.



(a) Calculate the distance from *B* to *C*, correct to two decimal places

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(b) What is the height of the building, correct to the nearest metre?

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Question 29 (2 marks)

Vodaphone shares were issued with a starting market value of $2.10. Penny bought 5150 shares at this price. She has to pay a 2.5% brokerage fee and is also required to pay the government stamp duty of 15 cents for every $100 or part thereof on the purchase price of the shares.

What was the total cost for Penny to buy these shares? **2**

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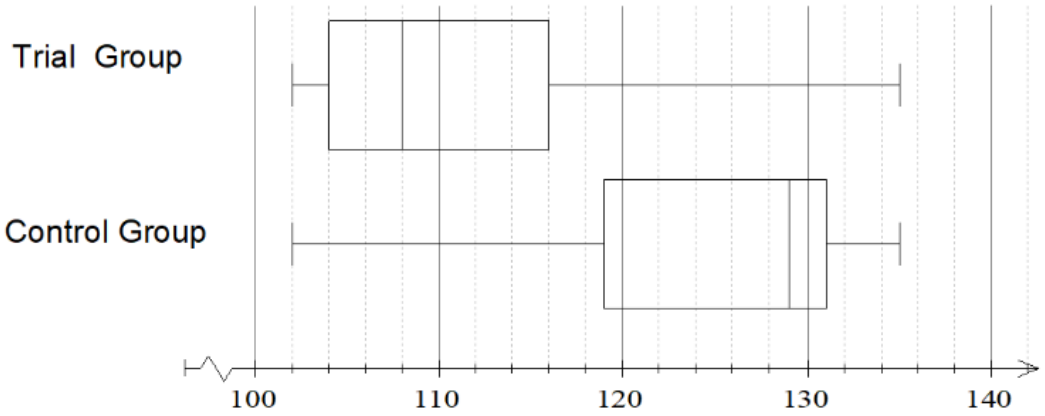
Question 30 (4 marks)

The graphs below compare the blood pressure of two groups of volunteers in a medical study. The trial group undertook a structured program of exercise and diet and the control group maintained their previous habits.



(a) What is the median of each group? **1**

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(b) Explain why the box and whisker plot gives a better picture of the results of the study than either the range or interquartile range on their own. **2**

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(c) Comment on the skewness of the results for the control group. **1**

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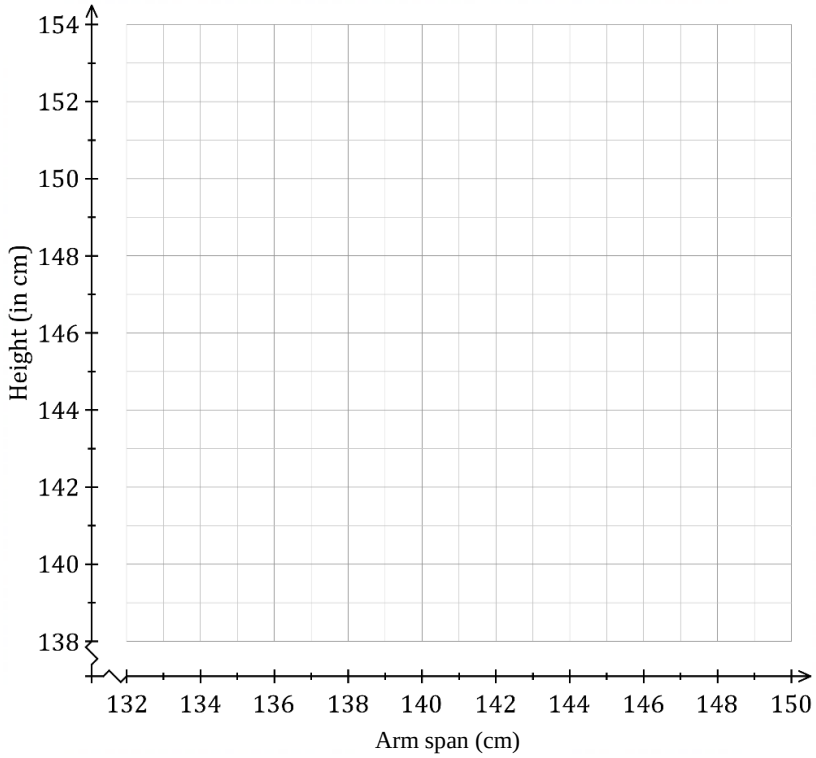
Question 31 (8 marks)

The table below shows arm span and height of seven children.

Arm span (cm)(x)	136	138	140	144	144	146	148
Height (cm)(y)	142	142	146	148	149	150	152

(a) Construct a scatterplot of the data given in the above table. **1**



(b) Draw a line of best fit on the scatterplot. **1**

(c) Classify the direction and strength of the linear association between height and arm span. **1**

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(d) Andy has an arm span of 139 cm. Use your line of best fit to estimate his height. **1**

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(e) Find Pearson's correlation coefficient. Answer correct to four decimal places. **1**

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Question 31 continues onto next page……

(f) Determine the equation of the least squares regression line in terms of x and y. **2**

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(g) Use the least squares regression line to determine the arm span of a 274cm giant. **1**

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Question 32 (4 marks)

A not-for-profit charity organisation raises money for children in Kenya to provide clothes, clean water, food and school supplies. Use the future value table below to answer the following questions.

Future value of $1						
Period	**2%**	**4%**	**6%**	**8%**	**10%**	**12%**
10	10.95	12.01	13.18	14.49	15.94	17.55
20	24.30	29.78	36.79	45.76	57.27	72.05
30	40.57	56.08	79.06	113.28	164.49	241.33
40	60.40	95.03	154.76	259.06	442.59	767.09

(a) For the next 5 years, the organisation raises $75 250 every month. If the interest rate is 8% p.a. compounded quarterly, what is the future value of the money that they raised? **2**

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(b) They aim to have raised $187 500 000 by the end of 30 years. If the interest rate was 10% p.a. compounded annually, how much would they have to raise monthly to meet their goal? **2**

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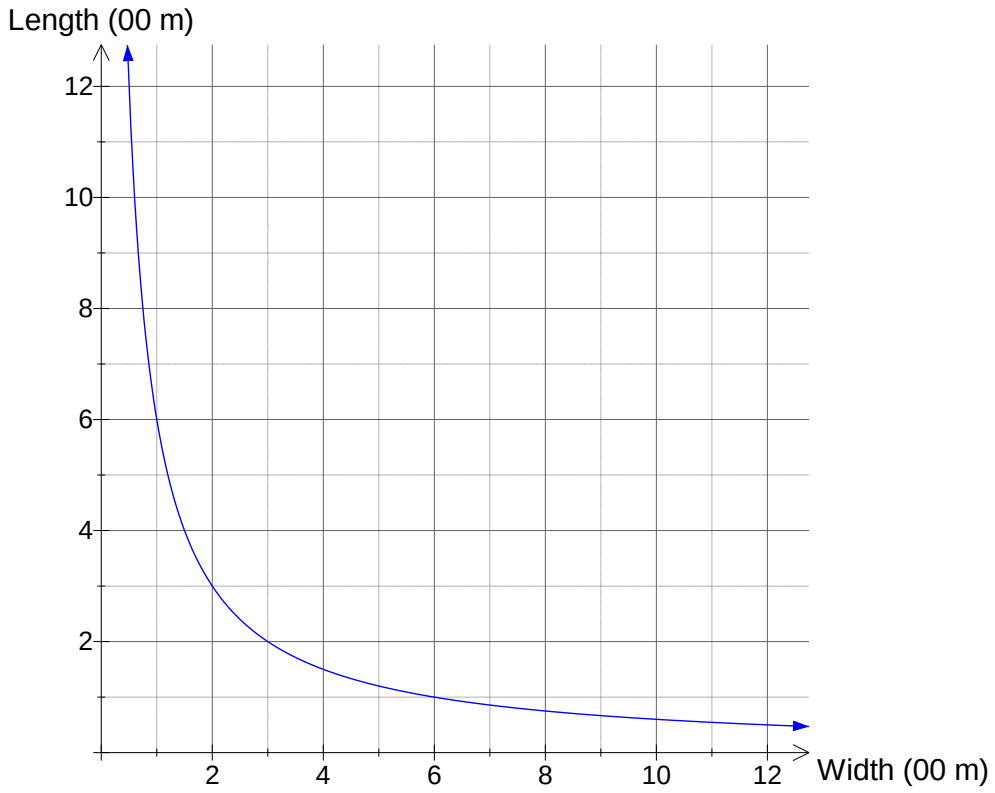
Question 33 (5 marks)

Farmer Nathan wishes to enclose a paddock with an area of 6 hectares. The graph shows the possible dimensions.



(a) Is the curve shown an exponential, parabola or hyperbola? **1**

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(b) If the width of the paddock was 100m, what was the length? **1**

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(c) If the paddock were to be a square, what would be its length? **1**

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(d) Which would cost more to fence, a paddock that was 800m wide, or one that was 300m wide? Justify your answer using the graph and relevant calculations. **2**

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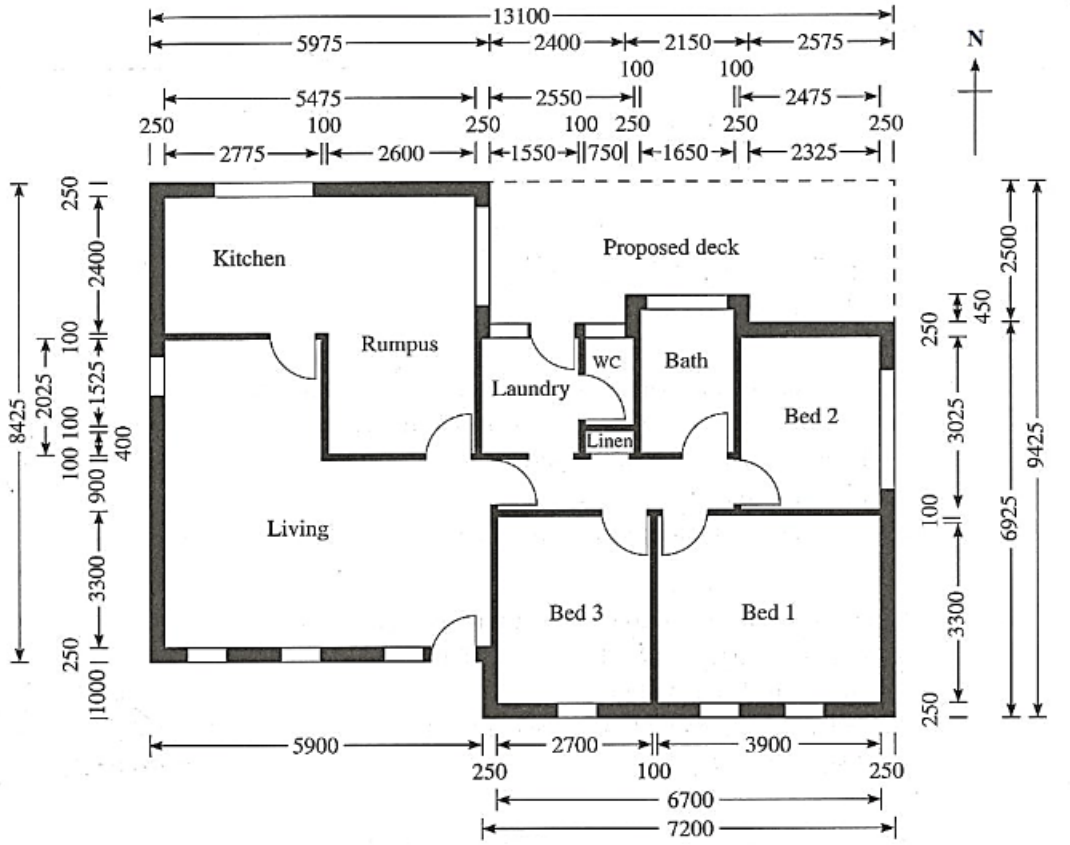
Question 34 (5 marks)

The plan of Mishka's three-bedroom house is shown below. All measurements are in mm.



(a) How many internal hinged doors are there in the house? **1**

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(b) What is the area of bedroom 1 in square metres? **1**

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(c) Mishka plans to lay carpet tiles in Bedroom 1. Each tile measures 30cm x 30cm. The tiles come in packets of 12, costing $30 per packet. How much will it cost to purchase tiles for this area? **3**

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Question 35 (3 marks)

The data on heights of Australian males and females reveals that the mean height of a male is 180 cm with a standard deviation of 8.5 cm whereas the mean height of a female is 172 cm with a standard deviation of 8 cm.

If, the population of males and females is equal in Australia, what percentage of females are taller than the average male? Assume that the heights follow a normal distribution. **3**

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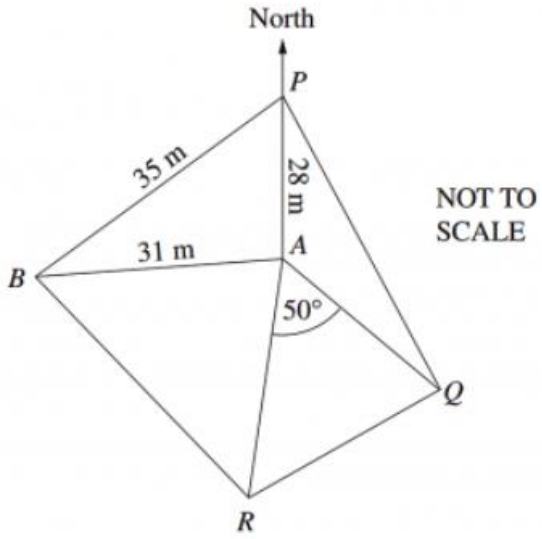
Question 36 (3 marks)

The diagram below shows a radial survey of a farmers land.



3

Find the bearing of B from P to the nearest degree.

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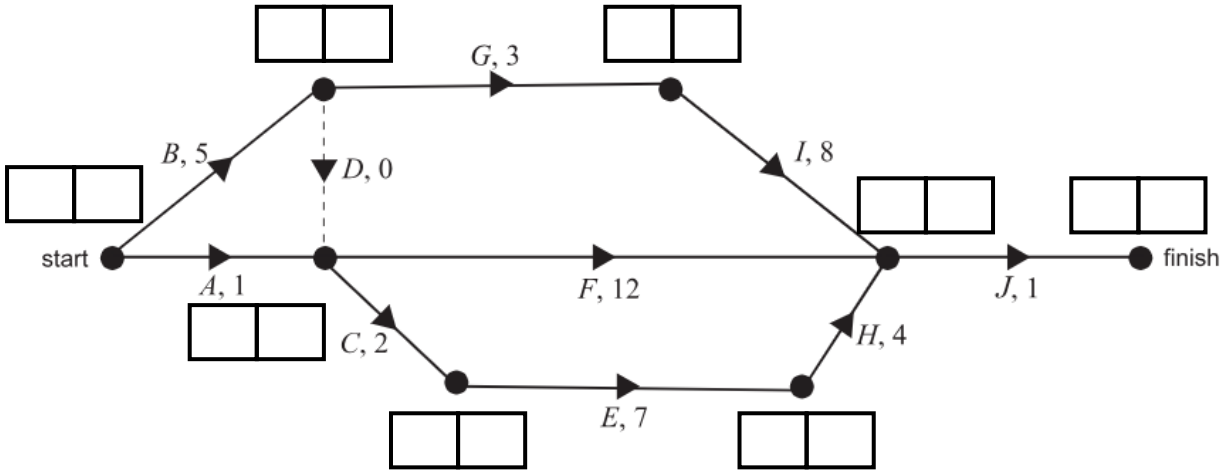
Question 37 (3 marks)

Oscar is building a new granny flat. The project involves different activities, labelled A to J. The duration of these activities to completion is given in days on the network diagram below.



(a) Which TWO activities immediately precede activity C? **1**

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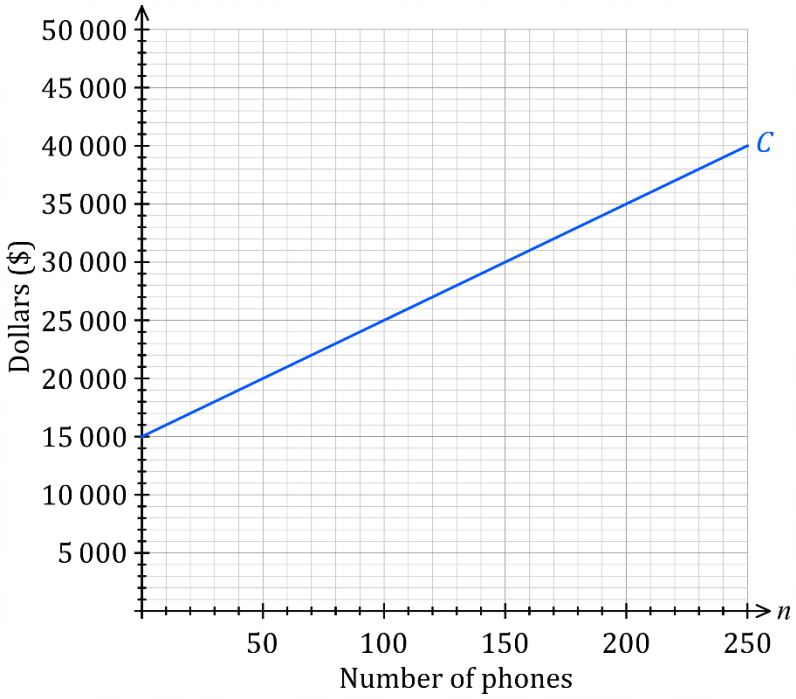
(b) Complete a forward and backward scan on the diagram to determine the earliest and latest starting times for each activity. **2**

Please turn over……

Question 38 (6 marks)

The cost, C, in dollars, of making n phones, is shown by the line in the graph below.



(a) What is the gradient of the line C **1**

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(b) Write an equation for the cost ($C), of making n phones. **1**

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(c) The income ($I), obtained from selling n phones is given by the equation I =200n. Draw the graph of this equation on the above graph. **1**

(d) How many phones would need to be made to make a profit of $15 000? **3**

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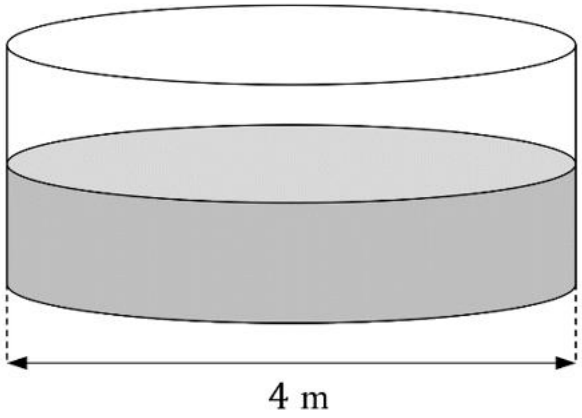
Question 39 (4 marks)

A large farm shed has a flat rectangular roof which is 10 metres wide by 20 metres long.
During a storm 15 mm of rain falls onto the roof in 10 minutes.

Rain that falls on the roof drains immediately into a cylindrical rainwater tank with a diameter of 4 metres.



4

Calculate the average rate at which the water level in the tank changes during the storm.
Answer in centimetres per minute to 1 decimal place.

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END OF EXAM

Student Number

12MAS – Miss Bannon

Caringbah High School

2023 HIGHER SCHOOL CERTIFICATE TRIAL EXAMINATION

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/15	/85	/100

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

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B. 4.08×10^{-3}

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C. 100 g for $0.45

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What is the percentage error in this measurement?

$$\frac{0.05}{0.8}$$

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B. ± 0.625%

C. ± 12.5%

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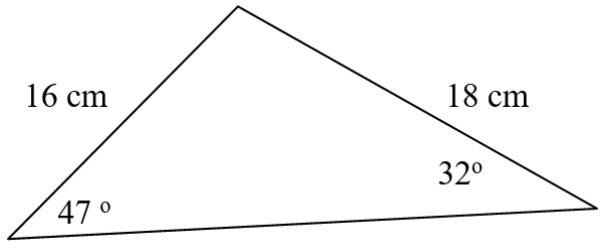
4. What is the area of the triangle shown below? Correct to the nearest whole number.



$$\frac{1}{2} \times 16 \times 18 \times \sin(101)$$

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B. 76 cm^2

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D. Third Party Property

6. Jo owns a machine that is initially worth \$500 000 and which depreciates at a rate of 18% per year using the declining balance method.

How much will it depreciate in the third year?

A. \$60 516
B. \$73 800
C. \$275 684
D. \$336 200

$500000(1-0.18)^2 - 500000(1-0.18)^3$

7. A homeowner borrows \$155 000. Interest is charged on the balance owing at a rate of 0.6% per month. A repayment of \$1200 is made at the end of each month.

What is the balance of the loan after the repayment at the end of the second month?

A. \$154 458.38
B. \$154 185.13
C. \$153 910.24
D. \$153 633.70

155000(1+0.6%)-1200
ANS(1+0.6%)-1200

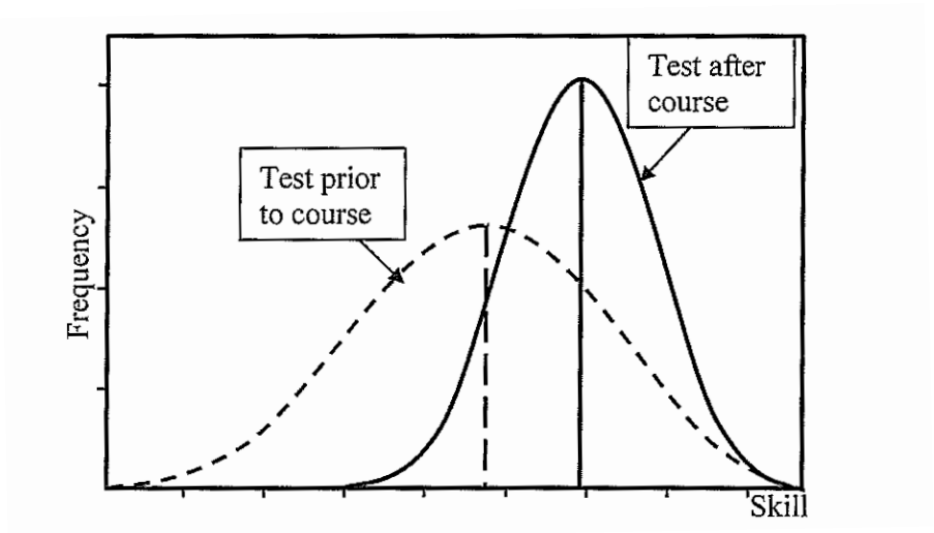
8. Expand and simplify $3x^2 - 10xy - 4x(2y - 3x)$

A. $15x^2 - 18xy$
B. $-9x^2 - 18xy$
C. $15x^2 - 2xy$
D. $-9x^2 - 2xy$

$3x^2 - 10xy - 8xy + 12x^2$

9. To determine the effectiveness of a training course, students undertook a skill test prior to the course and another test after they completed the training course.

The data collected is displayed in the graphs below.



Compared to the "prior test" data, the "after test" data has which of the following?

A. A higher mean and smaller standard deviation
B. A higher mean and a larger standard deviation
C. A lower mean and a smaller standard deviation
D. A lower mean and a larger standard deviation

10. The following table shows the monthly repayments on a personal loan.

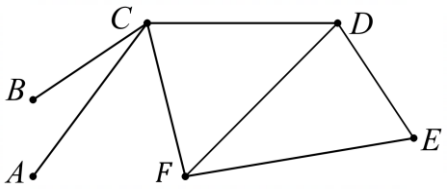
	Rate of Interest		
Amount Borrowed	5%	6%	7%
$	$	$	$
5 000	126	89	79
10 000	252	177	158
15000	377	266	237
20 000	503	354	315

The total interest paid on a loan of $10 000 over 20 years at 6% p.a. is:

A. $2124
B. $3540
C. $32 480
D. $42 280

$(177 \times 12 \times 20) - 10000$

11. A network graph is shown below.



How many edges will a spanning tree of this network have?

A. 5
B. 6
C. 7
D. 8

12. A new colour of paint is made using a mixture of red, yellow and white paint in the ratio 2 : 3 : 6. If the new paint comes in two-litre tins, how much yellow paint (to the nearest mL) is needed in each two-litre tin?

$(2000 \div 11) \times 3$

A. 364 mL
B. 545 mL
C. 667 mL
D. 1091 mL

13. Leo boards a plane in London at 6 pm on Wednesday 10th September and flies for 22 hours before arriving in Sydney. Given that Sydney's time zone is ten hours ahead of London's, what is the local time when he arrives in Sydney?

A. 6:00am Friday 12th
B. 2:00am Friday 12th
C. 6:00am Thursday 11th
D. 2:00am Thursday 11th

14. Blood alcohol for a female can be estimated using the following BAC formula

$$\text{BAC}_{\text{Female}} = \frac{10N - 7.5H}{5.5M},$$

where N is the number of standard drinks consumed, H is the number of hours since they started drinking and M is the person's mass in kilograms.

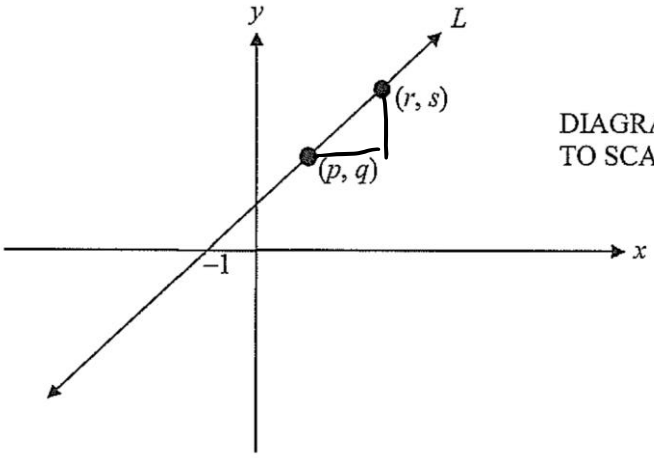
Georgie weighs 58 kg and had a BAC of 0.08 after drinking for 2 hours.

Approximately, how many standard drinks did she have?

A. 2
B. 3
C. 4
D. 5

$$\frac{10N - 15}{319} = 0.08$$

15. The line L passes through the points $(-1, 0)$, (p, q) and (r, s).



If $r = p + 3$ and $s = q + 9$, what is the equation of the line L?

A. $y = 2x + 1$
B. $y = 2x + 2$
C. $y = 3x + 3$
D. $y = 3x + 4$

$$m = \frac{s - q}{r - p} = \frac{q + 9 - q}{p + 3 - p} = \frac{9}{3} = 3$$

$$y = 3(x) + b$$
$$0 = 3(-1) + b$$
$$b = 3$$

End of Section 1

2022 HIGHER SCHOOL CERTIFICATE TRIAL EXAMINATION

Mathematics Standard 2

Student Number

Section II

Section II

85 marks
Attempt Questions 16–39
Allow about 2 hours and 5 minutes for this section

Instructions

- Write your Student Number at the top of this page.
- 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 on pages 24-25. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 16 (2 marks)

On a map of NSW, the distance between Tweed Heads and Bega is 131 mm.

The scale of the map is 1: 10 000 000.

What is the actual distance between Tweed Heads and Bega in kilometres?

2

131 : 1310 000 000 mm (1)

= 1310000m

= 1310km (1)

Question 17 (2 marks)

Cooper is moving out of home into a new unit and needs to work out a budget. For washing clothes, he needs to buy a washing machine and clothes dryer, and allow for the first two year's electricity usage.

- The washing machine costs $479 and is estimated to use 426 kWh per year.
- The clothes dryer costs $349 and is estimated to use 202 kWh per year.
- Electricity is charged at 27.799 cents per kWh.

Find the total cost of purchasing the washing machine and clothes dryer and running them for two years. **2**

479 + 349 + 2(426)×0.27799

+ 2(202)×0.27799

= $1177.16

Question 18 (2 marks)

A bank charges 0.0603% interest per day on the amount owing on a credit card. **2**

What is the interest charged in three weeks on a balance of $1500?

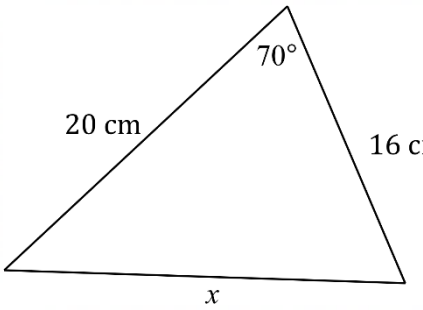
$FV = 1500(1+0.0603\%)^{21}$

= 1519.11

I = $19.11

Question 19 (2 marks)

Use the cosine rule to find the value of x, correct to two decimal places. **2**



Not to scale

$x^2 = 20^2 + 16^2 - 2(20)(16)\cos(70)$ (1)

$= 437.107...$

$x = 20.91\text{cm}$ (1)

Question 20 (3 marks)

The number of non-native plants growing on an island is modelled by the equation:

$$N = 2000(1.025)^t$$

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

(a) What is the annual percentage rate of increase in the number of plants based on this model? **1**

2.5%

(b) By the end of the year 2030, what is an estimate for the increase in the number of plants growing on the island since 2015? **2**

$N = 2000(1.025)^{15}$

$\approx 2896.596...$ (1)

Increase $\approx$ 897 (1)

Question 21 (2 marks)

The speed (v), in km/h, of a truck is inversely proportional to the weight (w kg) it carries. A truck carrying a weight of 1600 kg can travel at 80 km/h. What is the speed of the truck if the weight is 1250 kg ? **2**

$V = \frac{k}{w}$

$80 = \frac{k}{1600}$

$k = 12800$ (1)

$V = \frac{12800}{w}$

$V = \frac{12800}{1250}$

$= 102.4 \text{ km/h}$ (1)

Question 22 (3 marks)

A parent used Young's formula to calculate the required medication dosage for their child.

Young's formula is

$$\text{Dosage} = \frac{\text{Age of child (years)} \times \text{Adult dose}}{\text{Age of child (years)} + 12}.$$

They found that the child's dosage was one third of the adult dose. **3**

How old is the child?

If AO = 3, CO = 1

$1 = \frac{x \times 3}{x + 12}$

$x + 12 = 3x$

$12 = 2x$

$x = 6.$

- full marks awarded for answer with working (trial and error is ok)
- Need to get equation to one unknown only

Question 23 (5 marks)

Charlie earns a gross amount of $900 per week. He then pays union fees of $15 each week which are tax deductable.

Taxable income	*Tax on this income*
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5c for each $1 over $37 000
$90 001 – $180 000	$20 797 plus 37c for each $1 over $90 000
$180 001 and over	$54 097 plus 45c for each $1 over $180 000

(a) Using the tax table above, calculate Charlies tax payable, including a Medicare levy of 2% of his taxable income. **3**

Taxable income: $(900 \times 52) - (15 \times 52)$

$= \$46020$ (1)

$\text{Tax} = 3572 + 0.325(46020 - 37000)$

$= \$6503.5$ (1)

$\text{ML} = 0.02 \times 46020 = \$920.4$ (1)

$\therefore$ Tax payable $= 6503.5 + 920.4 = \$7423.90$

(b) Charlie's boss took out $157 each week as PAYG tax. At the end of the financial year, will Charlie receive a tax refund or will he owe more tax? How much? **2**

$157 \times 52 = 8164$ (1)

$\therefore$ Refund of $(8164 - 7423.9) = \$740.10$ (1)

Question 24 (2 marks)

A dishwasher has a price of $799. Mr Clean agreed to buy it, making a deposit of $150 and monthly repayments of $35 over two years.

What is the flat rate of interest p.a. , correct to one decimal place, being charged on the balance? **2**

$799 - 150 = 649$

$35 \times 12 \times 2 = 840$

$840 - 649 = 191$ (1)

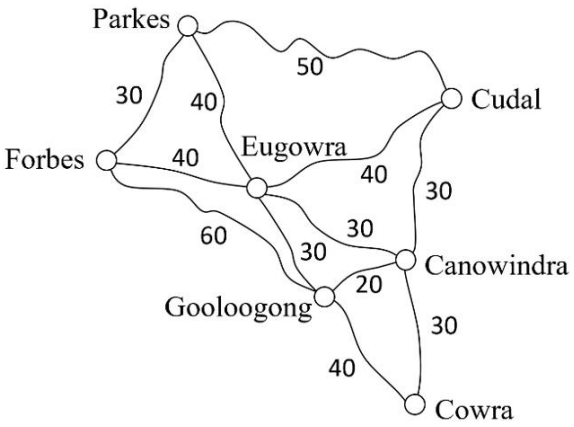
$191 = 649 \times r \times 2$

$\frac{191}{649 \times 2} = r$

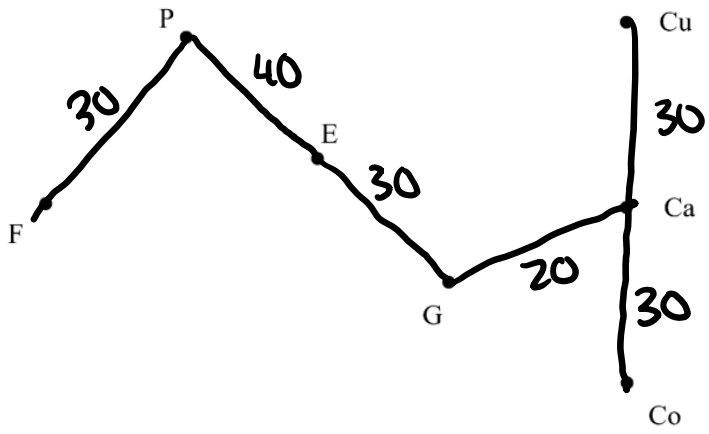
$r = 14.7\%$ (1)

Question 25 (2 marks)

The road map shows the roads connecting 7 towns. The numbers represent the distances along the roads between the towns, in kilometres.



By drawing a minimum spanning tree in the space below, calculate the minimum length of pipes required to supply water to all towns if the water pipes can only be laid along the roads. **2**



Minimum length = 180 km

Question 26 (4 marks)

45% of the residents in a local community have been administered only one vaccination against a spreading virus and 30% of the residents have been administered two vaccinations (so that they are fully vaccinated).

(a) What is the probability that a randomly chosen resident from the community has NOT been administered at least ONE vaccination?

$45 + 30 = 75$

$\therefore$ none $= 25\%$. **1**

(b) What is the probability that a randomly chosen resident from the community has been administered at least ONE vaccination?

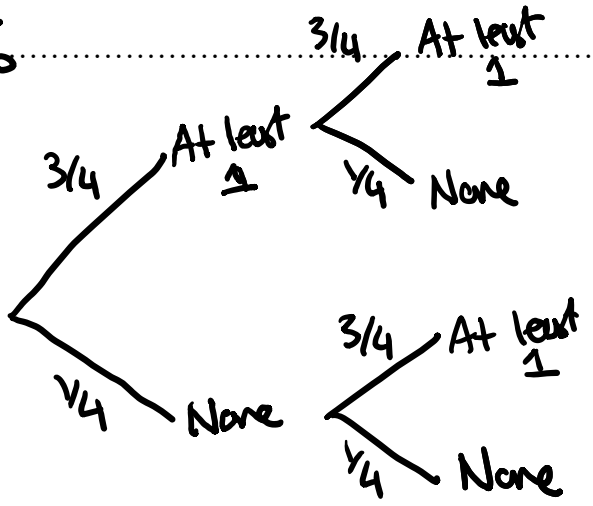
$100 - 25 = 75\%$. **1**

(c) If TWO residents are randomly selected from the community, what is the probability that at least ONE of them has been administered at least ONE vaccination?

$1 - P(\text{None}, \text{None})$

$= 1 - (\frac{1}{4} \times \frac{1}{4})$ **2**

$= \frac{15}{16}$ OR 0.9375 OR 93.75%.



Please turn over…

Question 27 (4 marks)

The table below shows the present value of a $1 annuity.

Number of periods	*Interest rate per period as a decimal*				
	0.001	0.00125	0.0015	0.00175	0.002
300	259.0707	250.0398	241.4379	233.2418	226.3477
330	280.9577	270.2690	260.1353	250.5239	240.7211
360	302.1982	289.7541	278.0106	266.9228	258.9154
390	325.2961	309.6290	297.0981	283.6291	261.9432

(a) What would be the present value of a $2000 per month annuity at 1.2% per annum for 25 years, with interest compounding monthly? **2**

2000 × 259·0707

= $518141·40

(b) Thomas borrowed $600 000 to purchase a home, with interest charged at 1.5% per annum compounding monthly. He agrees to repay the loan by making equal monthly payments over a 30-year period. **2**

What is the monthly payment ? Answer correct to the nearest cent.

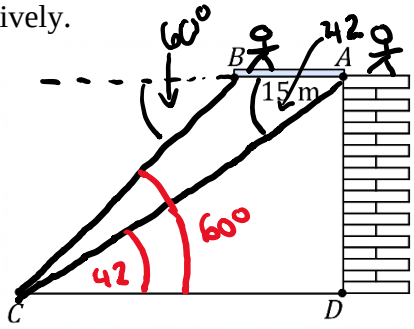
600 000 ÷ 289·7541

= $2070·72

1 mark awarded for evidence of changing r AND n

Question 28 (5 marks)

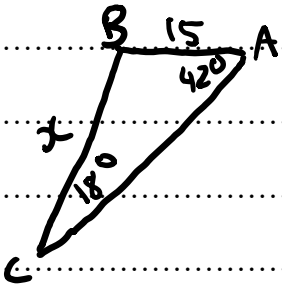
A 15 m platform (*AB*) extends from the top of one side of a building as shown in the diagram below. Point *C*, at ground level, is measured to be at angles of depression of 42° and 60° from points *A* and *B* respectively.



Not to scale

(a) Calculate the distance from *B* to *C*, correct to two decimal places

3



$\angle BCA = 60 - 42$ (1)

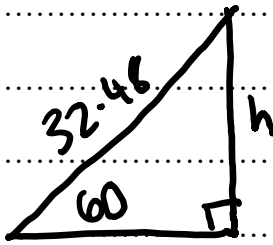
$\frac{x}{\sin(42)} = \frac{15}{\sin(18)}$ (2)

$x = \frac{15}{\sin(18)} \times \sin(42)$

$x \approx 32.48\text{m}$ (3)

(b) What is the height of the building, correct to the nearest metre?

2



(1)

$\sin(60) = \frac{h}{32.48}$

$h = 28.13$

$\approx 28\text{m}$ (1)

Question 29 (2 marks)

Vodaphone shares were issued with a starting market value of $2.10. Penny bought 5150 shares at this price. She has to pay a 2.5% brokerage fee and is also required to pay the government stamp duty of 15 cents for every $100 or part thereof on the purchase price of the shares.

What was the total cost for Penny to buy these shares? 2

$(2.1 \times 5150) = 10815$

SD: $10815 \div 100 = 108.15$

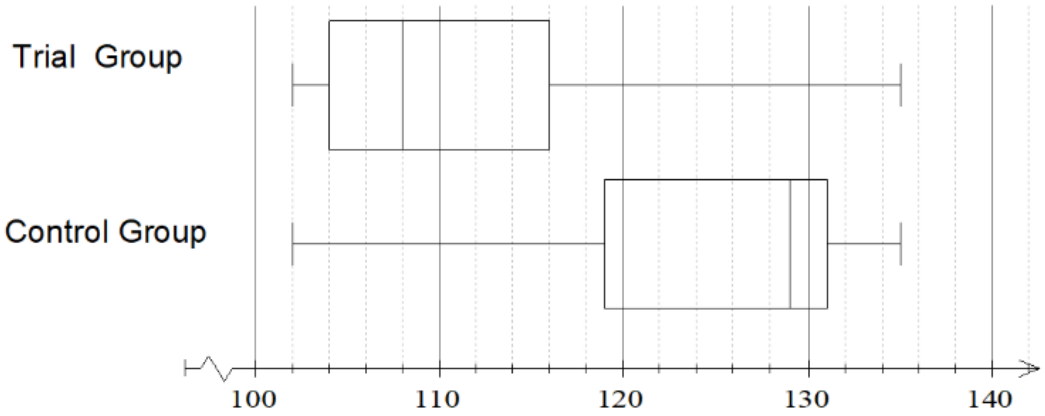
$\therefore 109 \times 0.15 = \$16.35$

BFee: $0.025 \times 2.1 \times 5150 = 270.375$

Cost = $\$11\,101.73$

Question 30 (4 marks)

The graphs below compare the blood pressure of two groups of volunteers in a medical study. The trial group undertook a structured program of exercise and diet and the control group maintained their previous habits.



(a) What is the median of each group? **1**

Trial: 108

Control: 129

(b) Explain why the box and whisker plot gives a better picture of the results of the study than either the range or interquartile range on their own. **2**

Need to mention something specific to this data eg. The range and IQR are very similar and so do not indicate what the actual values are. We need a BAW plot to view skewness, distribution and central tendancy.

(c) Comment on the skewness of the results for the control group. **1**

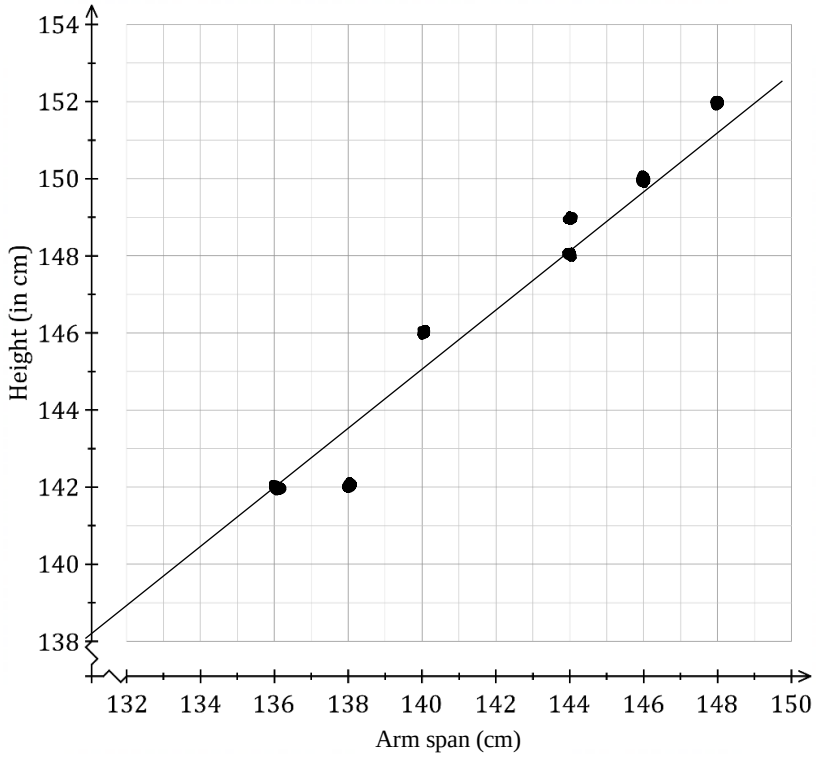
Negatively skewed.

Question 31 (8 marks)

The table below shows arm span and height of seven children.

Arm span (cm)(x)	136	138	140	144	144	146	148
Height (cm)(y)	142	142	146	148	149	150	152

(a) Construct a scatterplot of the data given in the above table. **1**



(b) Draw a line of best fit on the scatterplot. **1**

(c) Classify the direction and strength of the linear association between height and arm span. **1**

positive, strong

(d) Andy has an arm span of 139 cm. Use your line of best fit to estimate his height. **1**

≈144·5 any correct estimate off your LOBF

(e) Find Pearson's correlation coefficient. Answer correct to four decimal places. **1**

0·9811

Question 31 continues onto next page……

(f) Determine the equation of the least squares regression line in terms of x and y. **2**

$y = 0.87(x) + 23.73$

(2dp)

(g) Use the least squares regression line to determine the arm span of a 274cm giant. **1**

$274 = 0.87x + 23.73$

$x = 287.7$

Question 32 (4 marks)

A not-for-profit charity organisation raises money for children in Kenya to provide clothes, clean water, food and school supplies. Use the future value table below to answer the following questions.

Future value of $1						
Period	**2%**	**4%**	**6%**	**8%**	**10%**	**12%**
10	10.95	12.01	13.18	14.49	15.94	17.55
20	24.30	29.78	36.79	45.76	57.27	72.05
30	40.57	56.08	79.06	113.28	164.49	241.33
40	60.40	95.03	154.76	259.06	442.59	767.09

(a) For the next 5 years, the organisation raises $75 250 every month. If the interest rate is 8% p.a. compounded quarterly, what is the future value of the money that they raised? **2**

75250×24.30

$= \$1828575$

(b) They aim to have raised $187 500 000 by the end of 30 years. If the interest rate was 10% p.a. compounded annually, how much would they have to raise monthly to meet their goal? **2**

$187\,500\,000 \div 164.49$

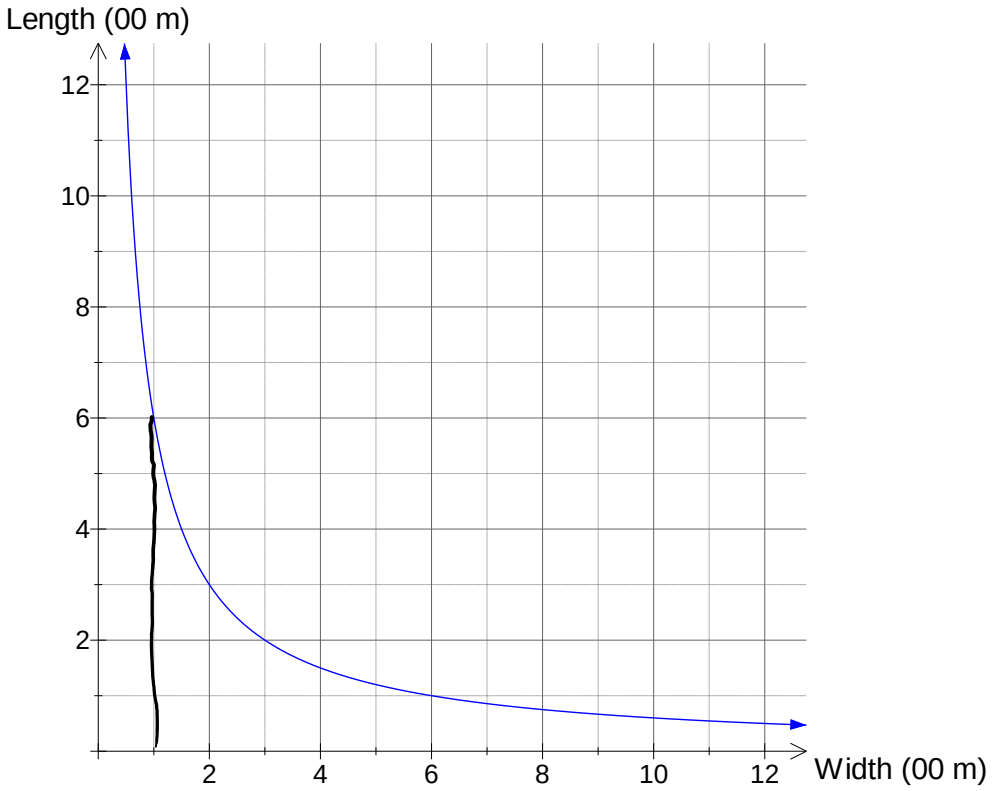
$= 1\,139\,886.92$ (yearly)

$\div 12$

$= \$94\,990.58$ monthly.

Question 33 (5 marks)

Farmer Nathan wishes to enclose a paddock with an area of 6 hectares. The graph shows the possible dimensions.



(a) Is the curve shown an exponential, parabola or hyperbola? **1**

hyperbola

(b) If the width of the paddock was 100m, what was the length? **1**

600m

(c) If the paddock were to be a square, what would be its length? **1**

250m (answers awarded with 5m error)

(d) Which would cost more to fence, a paddock that was 800m wide, or one that was 300m wide? Justify your answer using the graph and relevant calculations. **2**

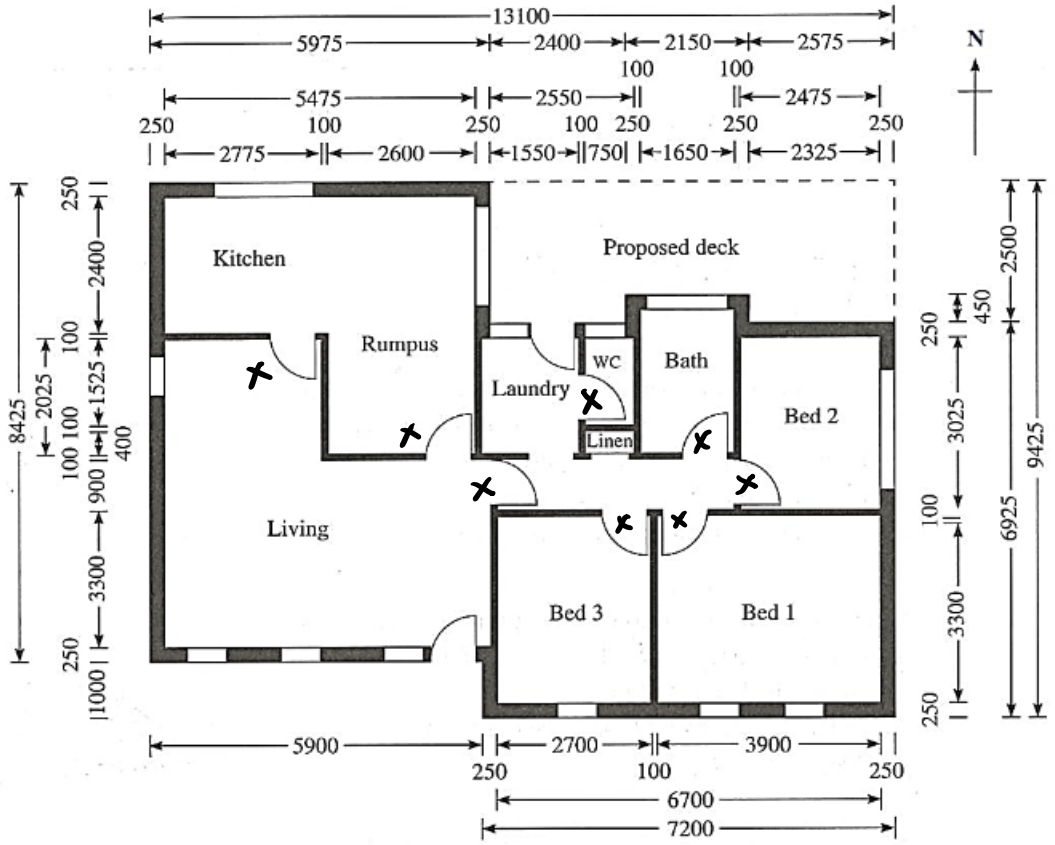
800 + 800 + 80 + 80 = 1760

300 + 300 + 200 + 200 = 1000

∴ 800m wide as larger perimeter = more fencing.

Question 34 (5 marks)

The plan of Mishka's three-bedroom house is shown below. All measurements are in mm.



(a) How many internal hinged doors are there in the house? **1**

8

(b) What is the area of bedroom 1 in square metres? **1**

3300 × 3900

3·3 × 3·9 = 12·87 m²

(c) Mishka plans to lay carpet tiles in Bedroom 1. Each tile measures 30cm x 30cm. The tiles come in packets of 12, costing $30 per packet. How much will it cost to purchase tiles for this area? **3**

30cm × 30cm

= 0·3 × 0·3 = 0·09 m²

12·87 ÷ 0·09 = 143

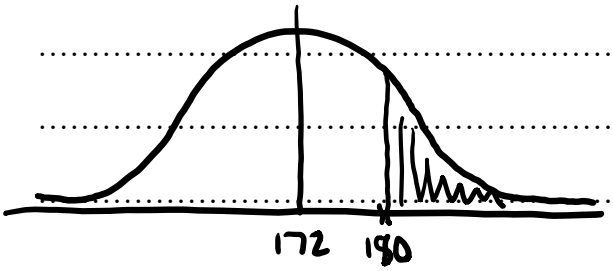
∴ 12 packets (12 × 12 = 144)

12 × 30 = $360

Question 35 (3 marks)

The data on heights of Australian males and females reveals that the mean height of a male is 180 cm with a standard deviation of 8.5 cm whereas the mean height of a female is 172 cm with a standard deviation of 8 cm.

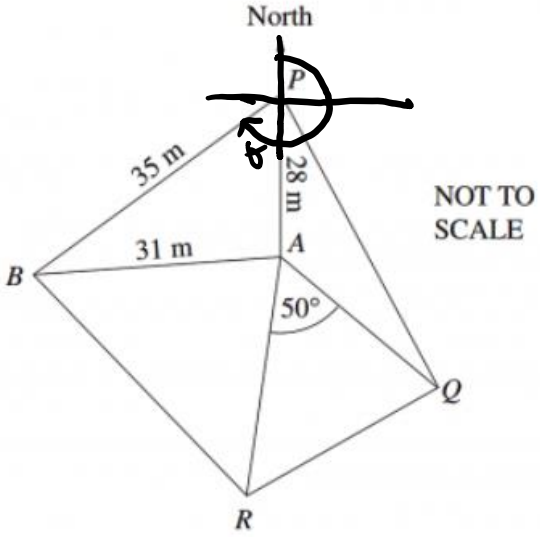
If, the population of males and females is equal in Australia, what percentage of females are taller than the average male? Assume that the heights follow a normal distribution. **3**



50% - 34% = 16%

Question 36 (3 marks)

The diagram below shows a radial survey of a farmers land.



3

Find the bearing of B from P to the nearest degree.

Bearing = $180° + \angle BPA (\theta)$

$$\cos\theta = \frac{35^2 + 28^2 - 31^2}{2(35)(28)}$$

$$= 57.676...°$$

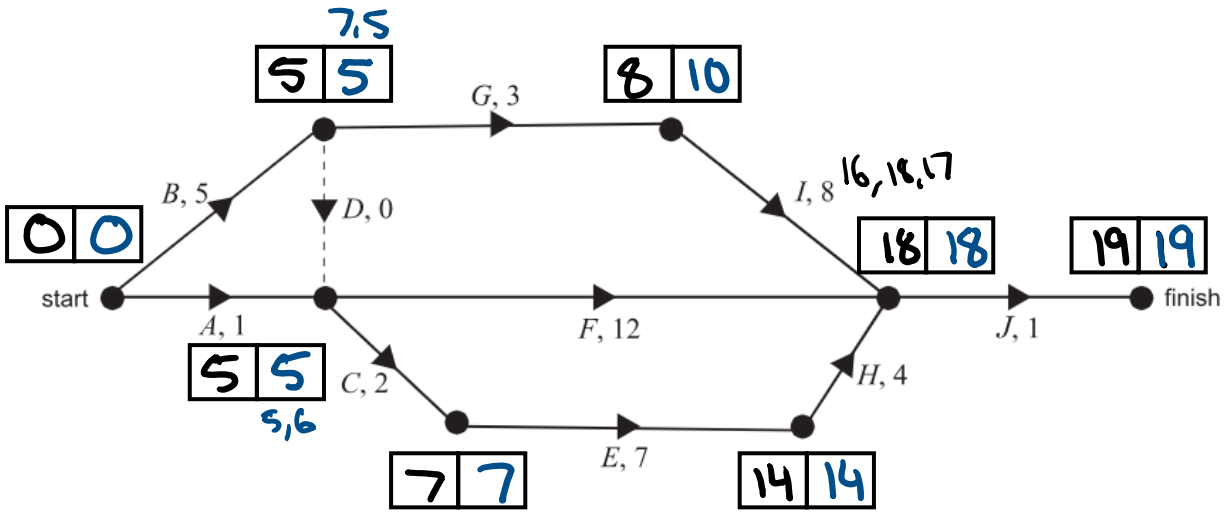
Bearing = $180 + 57.67...$

$$= 237°41'$$

$$\approx 238°$$

Question 37 (3 marks)

Oscar is building a new granny flat. The project involves different activities, labelled A to J. The duration of these activities to completion is given in days on the network diagram below.



(a) Which TWO activities immediately precede activity C? **1**

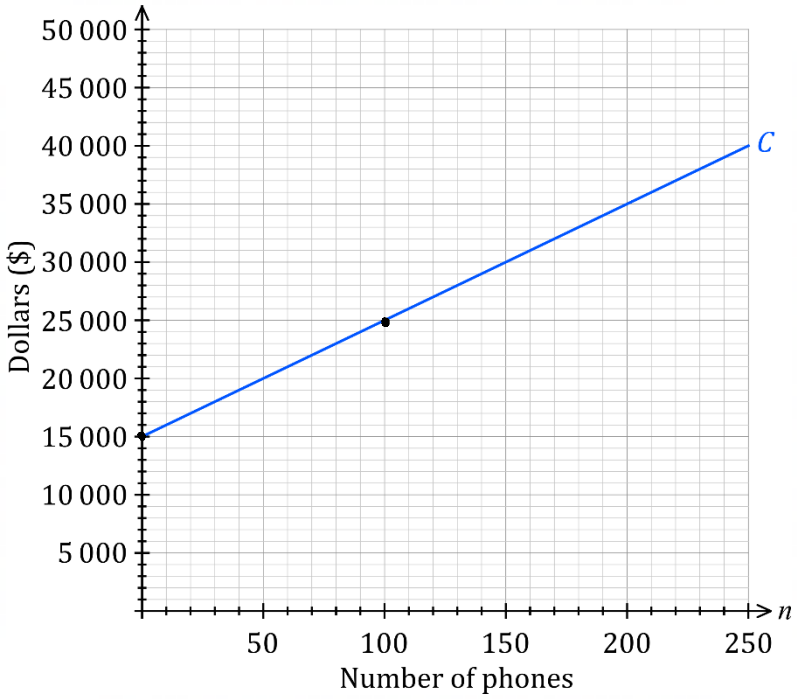
A, B

(b) Complete a forward and backward scan on the diagram to determine the earliest and latest starting times for each activity. **2**

Please turn over……

Question 38 (6 marks)

The cost, *C*, in dollars, of making *n* phones, is shown by the line in the graph below.



(a) What is the gradient of the line C **1**

$m = \frac{10000}{100} = 100$

(b) Write an equation for the cost ($C), of making n phones. **1**

$C = 100n + 15000$

(c) The income ($I), obtained from selling n phones is given by the equation I =200n. Draw the graph of this equation on the above graph. **1**

(d) How many phones would need to be made to make a profit of $15 000? **3**

$P = I - C$

$15000 = 200n - (100n + 15000)$

$= 100n - 15000$

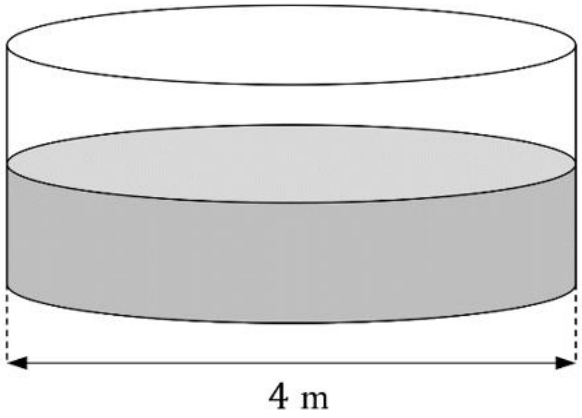
$30000 = 100n$

$n = 300.$

Question 39 (4 marks)

A large farm shed has a flat rectangular roof which is 10 metres wide by 20 metres long. During a storm 15 mm of rain falls onto the roof in 10 minutes.

Rain that falls on the roof drains immediately into a cylindrical rainwater tank with a diameter of 4 metres.



4

Calculate the average rate at which the water level in the tank changes during the storm. Answer in centimetres per minute to 1 decimal place.

$V = 10 \times 20 \times 0.015 = 3 m^3$

$V = \pi r^2 h$

$3 = \pi (2)^2 h$

$3 = 4\pi \times h$

$h = \frac{3}{4\pi} = 0.2387... m$

$0.2387 m \mid 10 min$

$0.0238... m \mid min$

$\approx 2.4 cm \mid min$

END OF EXAM