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Student Number

# Gosford High School

## 2026 Trial HSC 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
- For questions in Section II, show relevant mathematical reasoning and/ or calculations
- Write your Student Number at the top of this page

**Total Marks**

**100**

**Section I – 15 marks**

• Attempt Questions 1–15

• Allow about 25 minutes for this section

**Section II – 85 marks**

• Attempt Questions 16 - 40

• Allow about 2 hours and 5 minutes for this section

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**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.

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**1.** Jane takes four weeks of annual leave. Her weekly pay is $550 and her annual leave loading is $17\frac{1}{2}\%$ of four weeks pay.
What is Jane's total pay for this period of annual leave, rounded to the nearest dollar?

A. $2200

B. $2585

C. $2296

D. $385

**2.** A Football game is being played in New York (UTC-5), starting at 12:30pm on Friday. What is the time in Sydney (UTC +10) when the game starts in New York?

A. 10:30pm Friday

B. 5:30pm Friday

C. 3:30am Saturday

D. 5:30am Saturday

**3.** This set of data is arranged in order from smallest to largest. 5, 7, 10, $x$, 12, 19, 25 The range is four less than twice the value of $x$. Which one of the following is true?

A. The median is 12 and the interquartile range is 20.

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

C. The median is 11 and the interquartile range is 20.

D. The median is 11 and the interquartile range is 12.

**4.** A bag contains 150 jelly beans. Some of them are blue and the rest are green. The ratio of blue to green jelly beans is 1:4.

Timothy eats 5 of each colour.

What is the new ratio of blue to green jelly beans in simplest form?

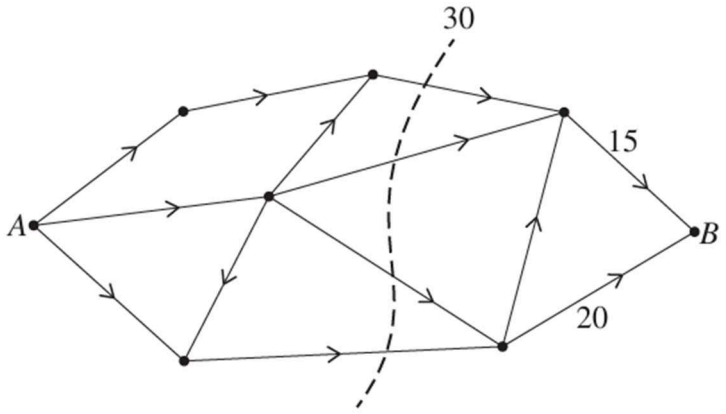
A. 6:23

B. 25:115

C. 5:23

D. 30:120

**5.** A network with source A and sink B is shown. The capacities of the two paths are labelled. The cut shown on the diagram has a capacity of 30.




Which of the following statements is correct?

A. The maximum flow is 30.

B. The maximum flow is 35.

C. The maximum flow is 30 or less.

D. The maximum flow is 30 or more.

**6.** Joseph is a personal trainer. He records his client's weight as part of his training regime.

How can this data be classified?

A. Continuous numerical.

B. Discrete numerical.

C. Ordinal categorical.

D. Nominal categorical.

**7.** What is the value of $a^2 - b$, when $a = -3.5$ and $b = -4$?

A. -8.25

B. -16.25

C. 8.25

D. 16.25

**8.** A spinner with 6 sections, has an equal number of red and green sections. This spinner is spun twice.
What is the probability of the same colour, when the spinner is spun twice?

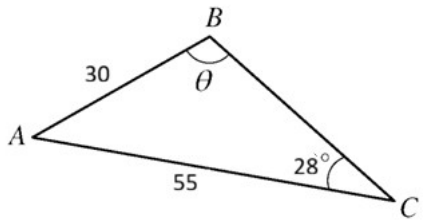
A. 0.5

B. 0.25

C. 0.1089

D. 0.2178

**9.** The diagram shows a triangle ABC where $AC = 55cm$, $AB = 30cm$, $\angle BCA = 28°$ and angle ABC is obtuse.




What is the size of the obtuse angle ABC, to the nearest degree?

A. 64°

B. 121°

C. 59°

D. 116°

**10.** An item was purchased for $770, including 10% GST.
What is the amount of GST included in the price?

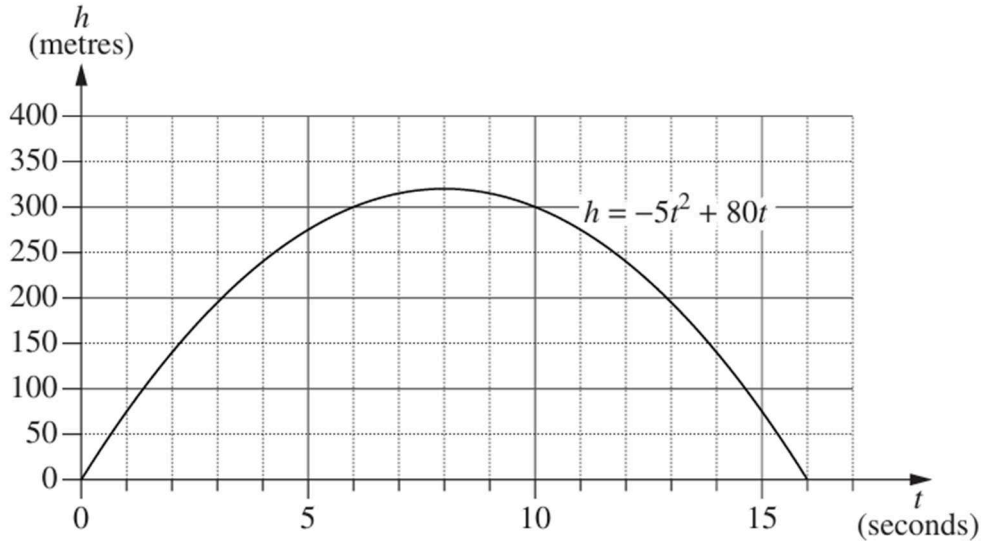
A. $77

B. $7

C. $70

D. $7.70

**11.** An object is projected vertically into the air. Its height, h metres, above the ground after t seconds is given by $h(t) = -5t^2 + 80t$




For how long is the object 200m or higher in the air?

A. 10 seconds

B. 5 seconds

C. 4 seconds

D. 9 seconds

**12.** The distribution for delivery times for pizza from House of Pizzas follows a normal distribution, with a mean of 25 minutes and standard deviation 5 minutes.

What percentage of pizzas have a delivery of greater than 30 minutes?

A. 68%

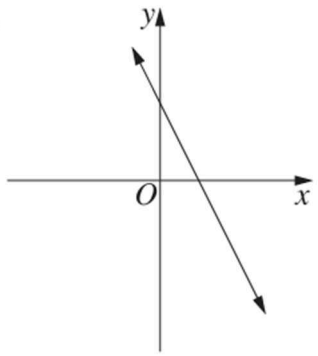
B. 2.5%

C. 0.15%

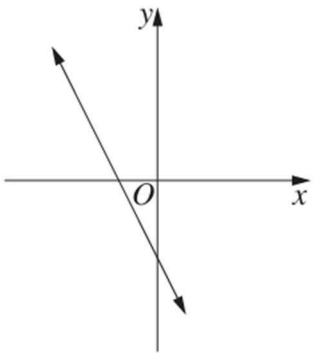
D. 16%

**13.** Which of the following could be the graph $y = -2x - 2$

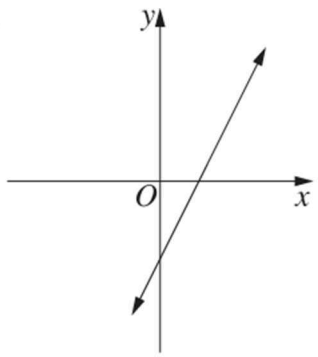
A.



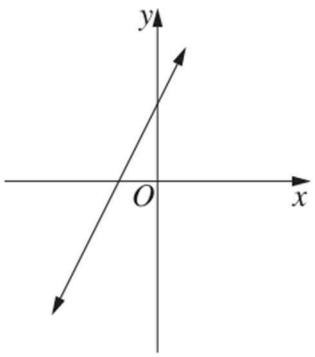

B.




C.




D.




**14.** Joan takes out a loan of $7000 for 6 years. Simple interest is charged on the loan.

The loan will charge a total of $3360 of interest over the 6 years.

What is the simple interest rate per annum charged on the loan?

A. 48%

B. 8%

C. 2.88%

D. 12.5%

**15.** A network contains 16 vertices. How many edges are required to form a spanning tree?

A. 8

B. 17

C. 15

D. 16

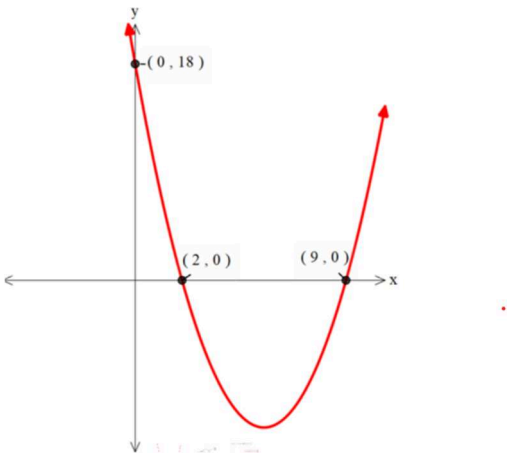
**Section II**

**85 marks**
**Attempt all questions**
**Allow about 2 hours and 5 minutes for this section**

Answer the questions in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is provided at the back of the examination paper.

**Question 16** (3 marks)

The graph of the quadratic function represented by the equation $y = x^2 - 11x + 18$ is shown.




(a) Find the values of $x$ *and* $y$ at the turning point of the graph. **2**

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(b) The graph shows $y = 18$ when $x = 0$. **1**
What is the other value of $x$ for which $y = 18$?

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**Question 17** (3 marks)

A thin pole stands vertically in the middle of a level playing ground. From point $A$ on the ground, the angle of elevation to the top of the pole, $T$, is 18°. From point $B$, also on the ground but 5.35 metres further from the foot of the pole than $A$, the angle of elevation to the top of the pole is 15°.

(a) Draw a sketch to represent this information. **1**

(b) Determine the height of the pole. **2**

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**Question 18** (3 marks) **3**

A plumber leases equipment which is valued at $55000.

The salvage value of the equipment at any time can be calculated using either of the two methods of depreciation shown in the table.

| **Method of depreciation** | **Rate of deprecition** |
|---|---|
| Straight line depreciation | $4000 per annum |
| Declining-balance depreciation | 10%p.a |

Under which method of depreciation would the salvage value of the equipment be lower at the end of 5 years? Justify your answer with appropriate mathematical calculations.

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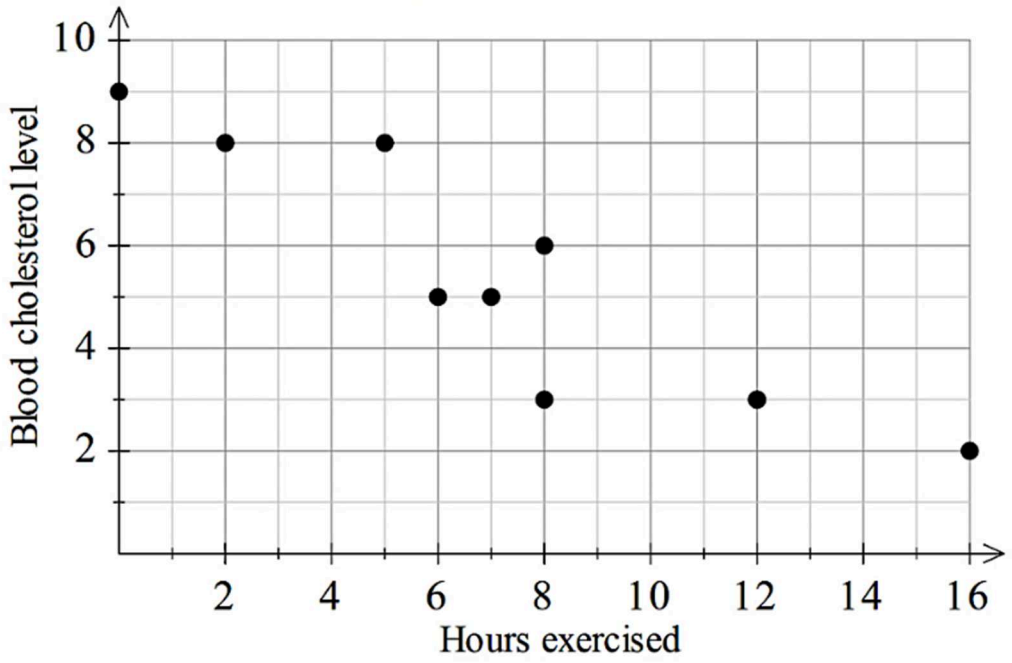
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**Question 19** (4 marks)

A set of bivariate data is collected by measuring the blood choloestrol level and hours exercised a week of nine adults. The graph shows a scatterplot of the results.




(a) Calculate the Pearson's correlation coefficient for the data, correct to two decimal places **1**

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(b) Identify the direction and the strength of the linear association between blood cholesterol level and hours exercised. **1**

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(c) The equation of the least-squares regression line is shown. **2**

$$Blood\ Cholesterol\ Level = -0.4679(Hours\ exercised) + 8.7717$$

An adult's blood cholesterol level is at 4.
Calculate the amount of hours exercised in a week for this adult, using the equation of the least squares regression line. Correct to the nearest 2 decimal places.

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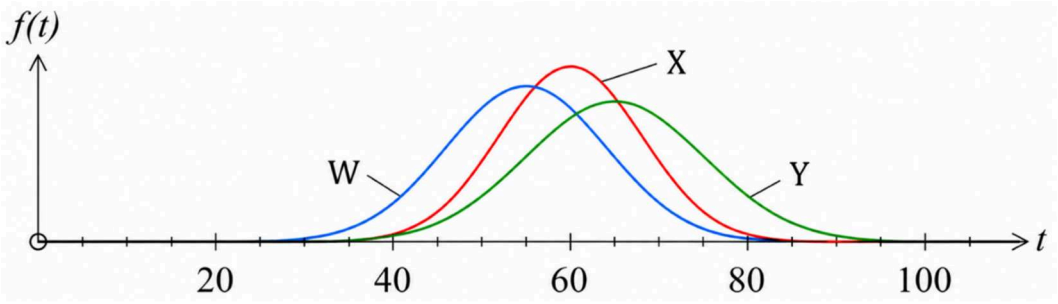
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**Question 20** (2 marks)

The graphs of the probability density functions of three normally distributed random variables $W$,$X$ and $Y$ are shown below.




State, with justification, which of the three random variables has: **1**

(a) the largest mean?

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(b) the smallest standard deviation? **1**

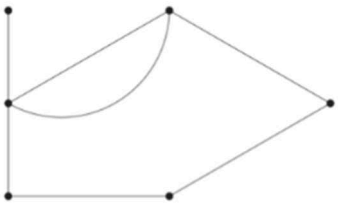
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**Question 21** (2 marks)

**2**

Is this graph Eulerian? Justify your answer with mathematical reasoning.



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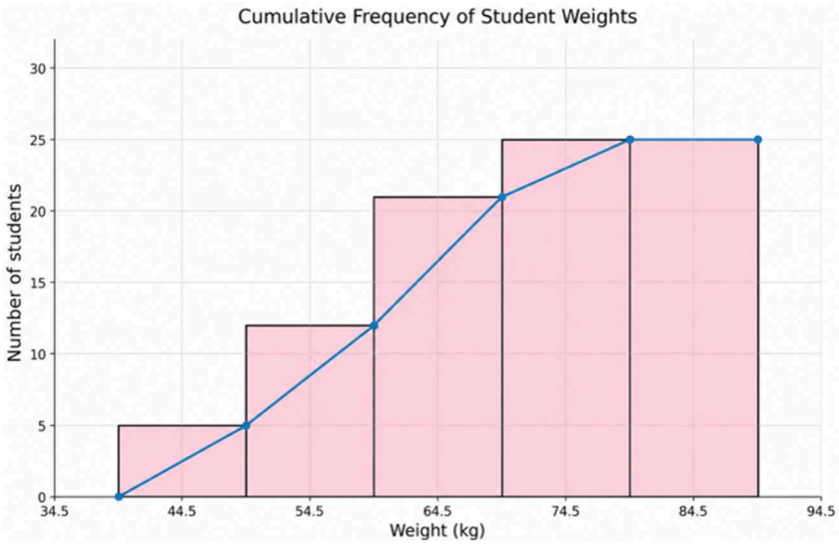
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**Question 22** (2 marks)

The weights of students in a class were recorded.

The results for this class are displayed in the cumulative frequency graph shown.




The lightest student in the class weighed 40kg and the heaviest in the class weighed 90kg.

Construct a box-plot for this class in the space below, using a number line **2**

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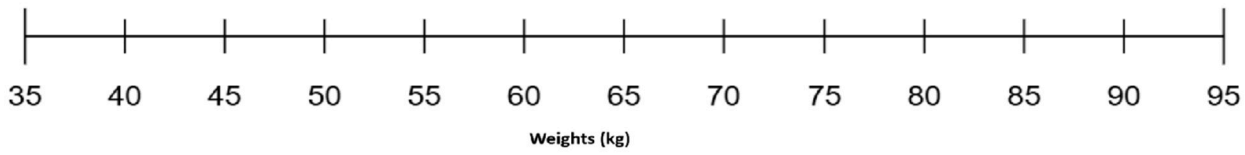
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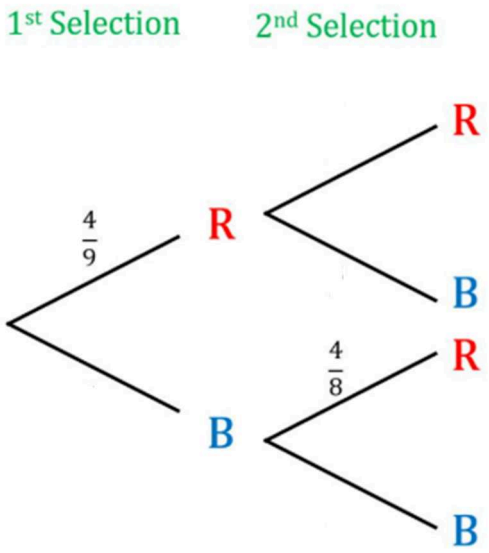
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**Question 23** (4 marks)

A bag contains 4 red balls and 5 black balls. Two balls are selected at random without replacement.

A partially completed tree diagram is shown below.




Complete the probability tree diagram and calculate the probability of selecting two balls of the same colour. **4**

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**Question 24** (3 marks)

Sonya and James each invest $2000 for 10 years.

- Sonya's investment earns simple interest at a rate of 5.5% per annum.
- James' investment earns an interest rate of 4.5% per annum, compounding quarterly.

By calculating the interest earned over the 10 years, determine who will have the greater amount. **3**

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**Question 25** (3 marks)

A bowl of hot soup is cooling on a table Its temperature, $T°C$, after $t$ minutes is given by the formula $T = 100(1.075)^{-t}$.

(a) Calculate the temperature of the soup after 2.5 minutes. **1**

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(b) What is the vertical intercept of this function and what does it represent? **2**

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**Question 26** (3 marks)

Jack and Jill are going to the beach 5km away. Jill will ride her bike at 12km/h while Jack will jog at 8km/h. How much head start should Jill give Jack so that they arrive at the beach at the same time? **3**

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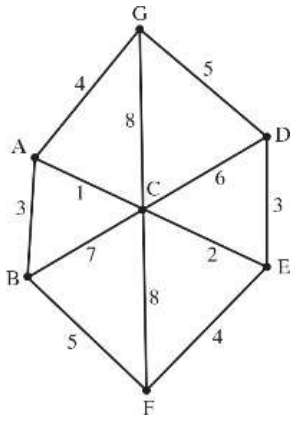
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**Question 27** (3 marks)

The graph to the right represents the length in km between seven towns. The towns must be connected by power lines which cost $700,000 per kilometre. The towns only need to be linked by one line – the entire network is not being constructed.




(a) Draw a minimum spanning tree connecting all 7 towns. **1**

(b) What is the minimum cost of connecting the towns? Justify your decision mathematically. **2**

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**Question 28** (4 marks)

The following formula can be used to calculate an estimate for blood alcohol content (BAC) for females.

$$BAC_{\text{Female}} = \frac{10N - 7.5H}{5.5M}$$

Where,

$N$ is the number of standard drinks consumed

$H$ is the number of hours drinking

$M$ is the person's weight in kilograms.

Samantha weighs 65kg. Her BAC was zero when she began drinking alcohol. At 10:00pm, after consuming 4 standard drinks, her BAC was 0.04.

Using the formula, estimate at what time Samantha began drinking alcohol, to the nearest minute. **4**

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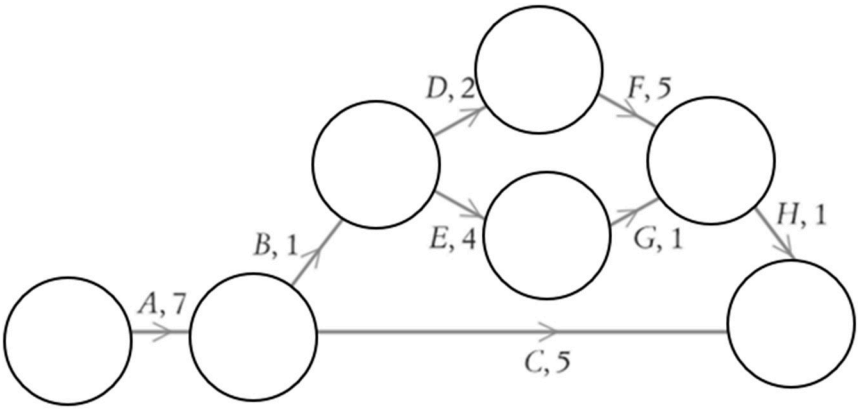
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**Question 29** (3 marks)

Use forward and backward scanning to identify the critical path. **3**




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**Question 30** (2 marks)

The marks, $x$, obtained by students in a maths exam were normally distributed with a mean of 85 and a standard deviation of 4. If the top 2.5% of students received an A, what was the minimum score to achieve an A? **2**

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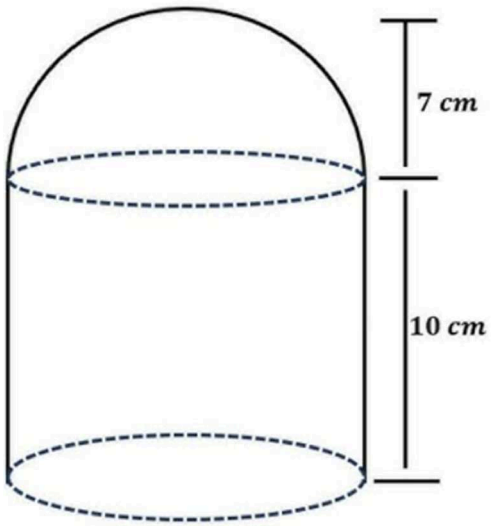
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**Question 31** (3 marks)

A cake is created using a cylinder and a hemisphere shaped top. The cylinder has a height of 10 cm and the hemisphere has a radius of 7 cm.




Calculate the surface area of the cake that is to be covered in icing (not including the base), correct to the nearest $cm^2$. **3**

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**Question 32** (3 marks)

An oil tanker hits a reef in the Pacific ocean and releases oil from its reservoirs. The oil slick extends 10km NE from the tanker and from the air can be seen to turn 158° for 25km then back to the tanker. Calculate the area of the oil slick. **3**

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**Question 33** (3 marks)

A full container has 5.2 L of a mixture of cordial and water in the ratio 1 : 3. After removing 1.6 L of the mixture, more water is added to refill the container. What is the ratio of cordial to water in the final mixture? **3**

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**Question 34** (6 marks)

Joanne borrowed $595 000 to buy a house. The loan is to be repaid over 25 years at a rate of 6.25% per annum, compounded monthly. The repayments have been set at $3 925 per month.

The interest charged and the balance owing for the first four months of the loan are shown in the spreadsheet below.

| Month | Principal (at start of month) | Interest charged | Monthly repayment | Balance (at end of month) |
|---|---|---|---|---|
| 1 | $595 000 | $3 098.96 | $3 925 | $594 173.96 |
| 2 | $594 173.96 | A | $3 925 | $593 343.62 |
| 3 | $593 343.62 | $3 090.33 | $3 925 | $592 508.95 |
| 4 | $592 508.95 | $3 085.98 | $3 925 | B |

(a) Some values in the table are missing. Write down the values for A and B. **2**

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(b) What is the total to be repaid over the 25 years? **1**

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(c) After 10 years of repaying the loan, Joanne decides to make a lump sum payment of $100 000 and to continue making monthly repayments of $3 925. The loan will then fully be repaid after a further 132 monthly repayments. **3**

Using your answer from part (b), calculate how much less Joanne will pay overall by making the lump sum payment.

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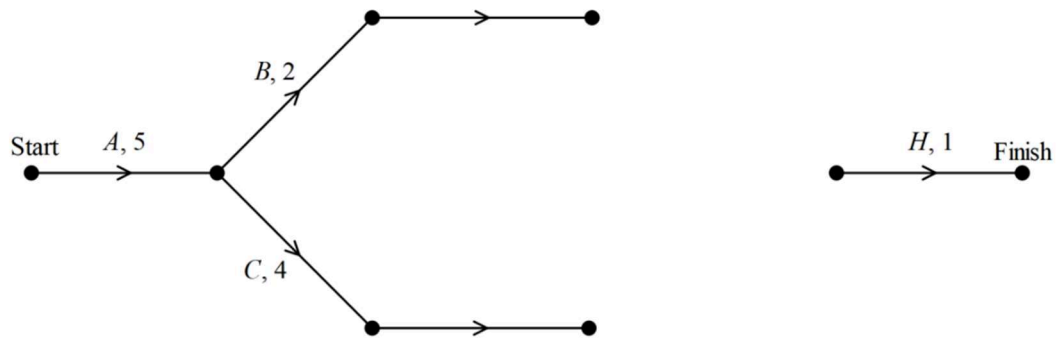
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**Question 35** (5 marks)

The drama department at a school is planning a school musical production. The following table outlines the key activities, their durations and which activities must be completed before others can begin.

| Activity | Description | Duration (weeks) | Predecessor(s) |
|---|---|---|---|
| *A* | Write script | 5 | — |
| *B* | Audition cast | 2 | *A* |
| *C* | Design set and costumes | 4 | *A* |
| *D* | Cast rehearsals | 6 | *B* |
| *E* | Build set and create costumes | 3 | *C* |
| *F* | Rehearse with full staging | 4 | *D, E* |
| *G* | Technical setup (lighting/sound) | 1 | *E* |
| *H* | Final dress rehearsal | 1 | *F, G* |

(a) Complete the network diagram for the school musical production. **2**




(b) Determine the minimum time needed to complete the project. **1**

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(c) What is the float time for Activity E? **1**

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(d) Activity C is delayed by 3 weeks causing a delay to the entire production. By how many weeks is the overall production delayed? **1**

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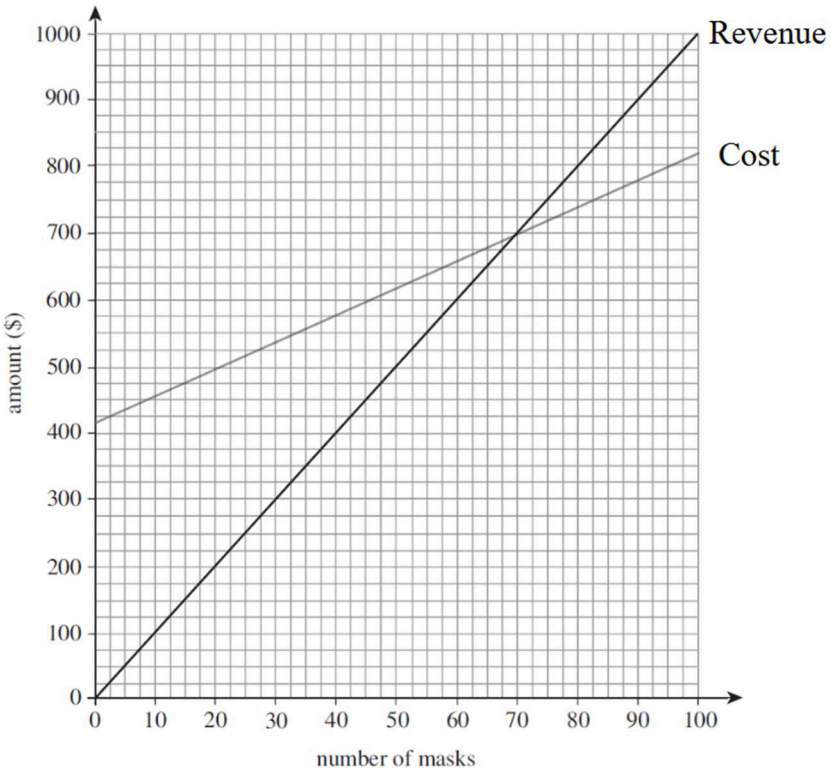
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**Question 36** (5 marks)

Willow's business Fashion Face Masks makes and sells embroidered face masks. Willow purchases plain cloth masks and embroiders them with different patterns.

The cost of each plain mask is $4 and Willow sells the embroidered masks for $10 each.
Willow invests $420 in an embroidery machine and a thread kit to make 100 masks.

The production cost and revenue generated from the sale of the embroidered masks can be modelled with two linear equations, as shown in the graph.




NOT TO SCALE

(a) Using the graph, solve the two equations simultaneously and explain the significance of this solution for Willow's business. **2**

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(b) How many masks does Willow need to sell to obtain a revenue of $350. **1**

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(c) How much profit does Willow make if she sells 100 masks? **2**

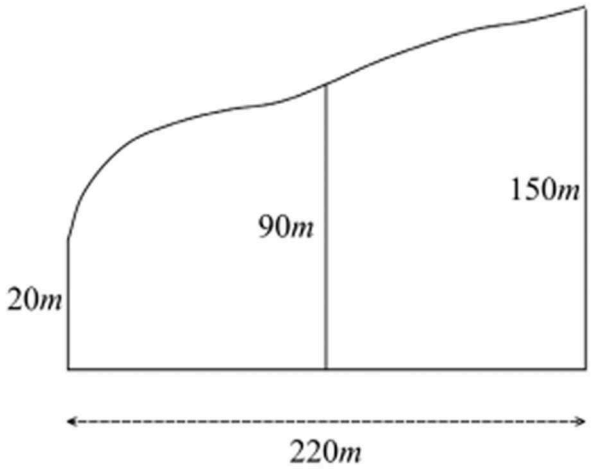
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**Question 37** (3 marks)

The diagram below shows a survey of the land that Josie will build her house on.




(a) Use two applications of the trapezoidal rule to estimate the area of land to the nearest whole number. **2**

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(b) Do you think your approximation in part (a) is higher, lower, or about equal to the actual area of this land? Provide reasons for your decision. **1**

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**Question 38** (2 marks)

A soccer goal is 8m wide. A player shoots for goal when he is 20m from one post and 15m from the other post. Within what angle must the shot be made to score a goal? **2**

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**Question 39** (3 marks)

The table shows the income tax rate for Australian residents for the 2025 – 2026 financial year.

| Taxable income | Tax on this income |
|---|---|
| 0 – $18,200 | Nil |
| $18,201 – $45,000 | 16c for each $1 over $18,200 |
| $45,001 – $135,000 | $4,288 plus 30c for each $1 over $45,000 |
| $135,001 – $190,000 | $31,288 plus 37c for each $1 over $135,000 |
| $190,001 and over | $51,638 plus 45c for each $1 over $190,000 |

At the end of the 2025 – 2026 financial year, Kale's tax payable was $154 536, excluding the medicare levy.

What was Kale's taxable income? **3**

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**Question 40** (2 marks)

Sam believes he did better on his Math exam than his Physics exam. The Physics exam had a mean score of 55 and a standard deviation of 17 and he achieved 67 out of 100. On the Math exam, he achieved 72 out of 100 and the class had a mean of 64 and a standard deviation of 12. Evaluate the reasonableness of Sam's statement, using mathematical reasoning. **2**

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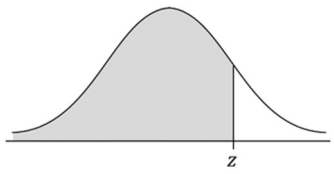
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**Question 41** (2 marks)

A random variable is normally distributed with mean 0 and standard deviation 1. The table below gives the probability that this random variable lies below $z$ for different values of $z$.

| $z$ | .0 | .1 | .2 | .3 | .4 | .5 | .6 | .7 | .8 | .9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.500 | 0.540 | 0.579 | 0.618 | 0.655 | 0.691 | 0.726 | 0.758 | 0.788 | 0.816 |
| 1 | 0.841 | 0.864 | 0.885 | 0.903 | 0.919 | 0.933 | 0.945 | 0.955 | 0.964 | 0.971 |




A manufacturer produces luxury scented candles. The mass of wax in each candle is normally distributed with a mean of 300 grams and a standard deviation of 4 grams. **2**
What percentage of candles would you expect to contain more than 302 grams of wax?

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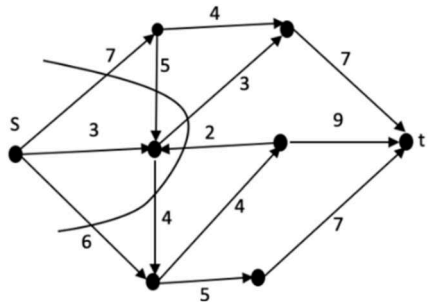
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**Question 42** (4 marks)

A plumber needs to fix a system of pipes. The sink ($t$)is connected to the water source ($S$) by an interconnected series of one-directional pipes. The capacity of each pipe is shown below.

(a) What is the capacity of the cut below? **2**

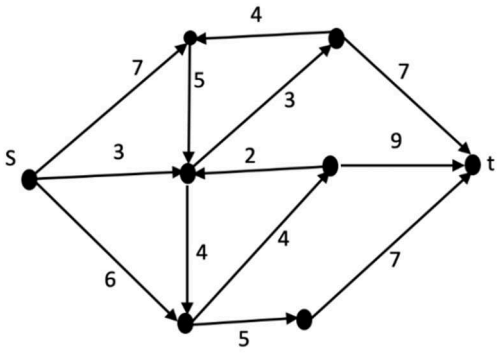



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(b)The plumber experienced difficulty in cutting the pipes and wants to identify the smallest cut possible (in terms of capacity). By finding the maximum flow, explain why this is the smallest cut possible. Justify your response on the diagram below. **2**




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**End of Examination**

**Section II extra writing space.**

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

**Solutions**

# Gosford High School

## 2026 Trial HSC 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
- For questions in Section II, show relevant mathematical reasoning and/ or calculations
- Write your Student Number at the top of this page

**Total Marks**

**100**

**Section I – 15 marks**

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

**Section II – 85 marks**

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

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**Section I**

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

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

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

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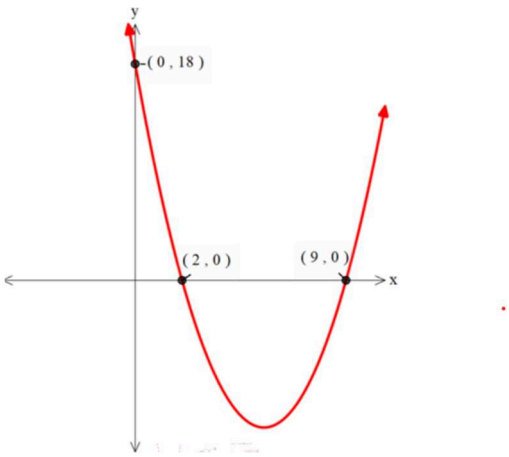
**Section II**

**85 marks**
**Attempt all questions**
**Allow about 2 hours and 5 minutes for this section**

Answer the questions in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is provided at the back of the examination paper.

**Question 16** (3 marks)

The graph of the quadratic function represented by the equation $y = x^2 - 11x + 18$ is shown.




(a) Find the values of $x$ *and* $y$ at the turning point of the graph. **2**

$x - TP = \frac{(2+9)}{2} = 5.5$ **(1 mark for correct x-value)**

$y - TP = 5.5^2 - 11 \times (5.5) + 18 = -12.25$ **(1 mark for correct y-value based on x-value)**

$TP\ is\ (5.5, -12.25)$

(b) The graph shows $y = 18$ when $x = 0$.
What is the other value of $x$ for which $y = 18$? **1**

$5.5 \times 2 = 11$

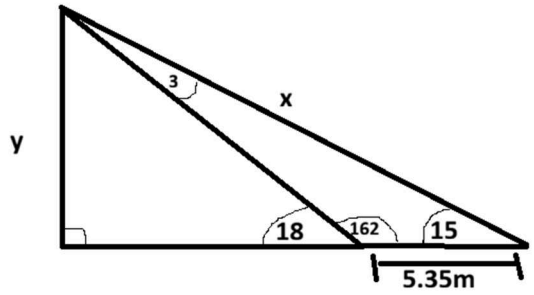
$x = 11$ **(1 mark for correct x-value, based off answer in (a))**

**Question 17** (3 marks)

A thin pole stands vertically in the middle of a level playing ground. From point $A$ on the ground, the angle of elevation to the top of the pole, $T$, is 18°. From point $B$, also on the ground but 5.35 metres further from the foot of the pole than $A$, the angle of elevation to the top of the pole is 15°.

(a) Draw a sketch to represent this information. **1**

**(1 mark for accurate sketch including 15°, 18°, 5.35m)**




(b) Determine the height of the pole. **2**

$$\frac{x}{sin162} = \frac{5.35}{sin3}$$

$$x = \frac{5.35 \times sin162}{sin3}$$

$x = 31.58$ **(1 mark for correct value of an unknown side)**

$$sin15 = \frac{y}{31.58}$$

$$31.58 \times sin15 = y$$

$y = 8.18m\ (2\ d.p)$ **(1 mark for correct value of height of pole, based on previous side)**

**Question 18** (3 marks)

A plumber leases equipment which is valued at $55000.

The salvage value of the equipment at any time can be calculated using either of the two methods of depreciation shown in the table.

| Method of depreciation | Rate of deprecition |
|---|---|
| Straight line depreciation | $4000 per annum |
| Declining-balance depreciation | 10%p.a |

Under which method of depreciation would the salvage value of the equipment be lower at the end of 5 years? Justify your answer with appropriate mathematical calculations. **3**

Straight -line method

$S = 55000 - (4000 \times 5)$

$S = \$35000$ **(1 mark for correct straight-line value)**

Declining balance Method

$S = 55000 \times (1 - 0.1)^5$

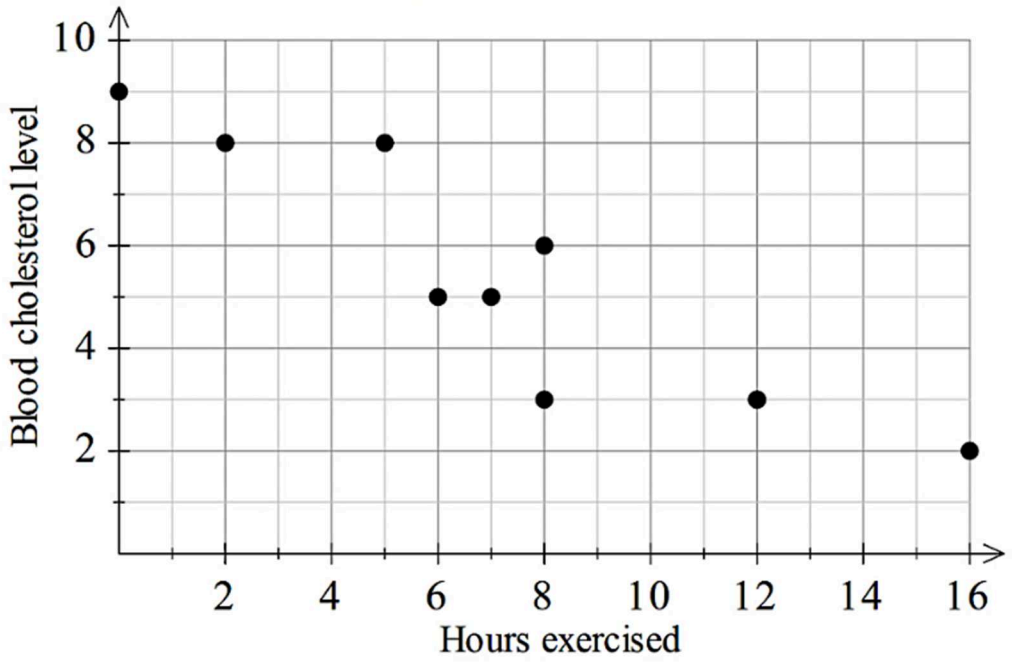
$S = \$32476.95$ **(1 mark for correct declining-balance value)**

The Declining-balance method is a lower salvage value at the end of the 5 years.

**(1 mark for correct statement based off answers)**

**Question 19** (4 marks)

A set of bivariate data is collected by measuring the blood choloestrol level and hours exercised a week of nine adults. The graph shows a scatterplot of the results.




(a) Calculate the Pearson's correlation coefficient for the data, correct to two decimal places **1**

$r = -0.9$ **(1 mark for correct value)**

(b) Identify the direction and the strength of the linear association between blood cholesterol level and hours exercised. **1**

Negative and strong linear association. **(1 mark for both 'negative' and 'strong')**

(c) The equation of the least-squares regression line is shown. **2**

$$Blood\ Cholesterol\ Level = -0.4679(Hours\ exercised) + 8.7717$$

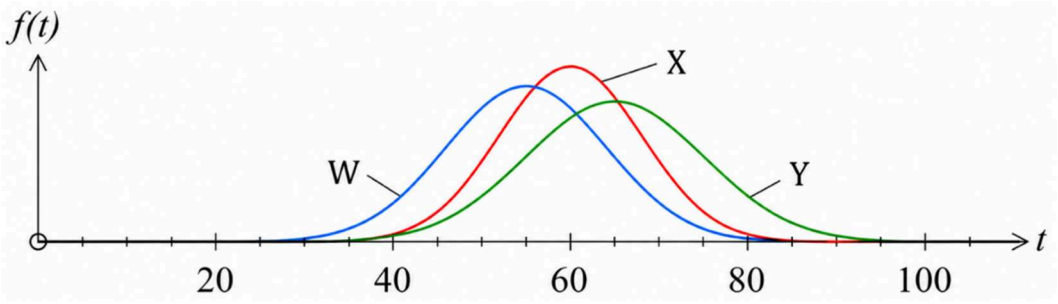
An adult's blood cholesterol level is at 4.
Calculate the amount of hours exercised in a week for this adult, using the equation of the least squares regression line. Correct to the nearest 2 decimal places.

$4 = -0.4679(Hours\ exercised) + 8.7717$ **(1 mark for correct substitution)**
$4 - 8.7717 = -0.4679H$
$-4.7717 = -0.4679H$
$\frac{-4.7717}{-0.4679} = H$

$H = 10.20$ **(1 mark for correct answer of hours)**

**Question 20** (2 marks)

The graphs of the probability density functions of three normally distributed random variables $W$,$X$ and $Y$ are shown below.




State, with justification, which of the three random variables has:
(a) the largest mean?

**1**

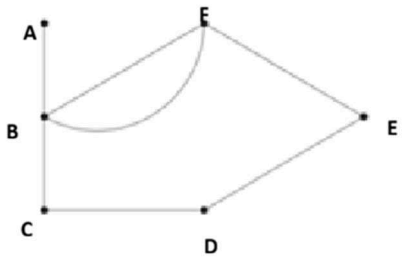
Y has the largest mean **(1 mark for correct answer)**

(b) the smallest standard deviation?

X has the smallest standard deviation **(1 mark for correct answer)** **1**

**Question 21** (2 marks)

Is this graph Eulerian? Justify your answer with mathematical reasoning.



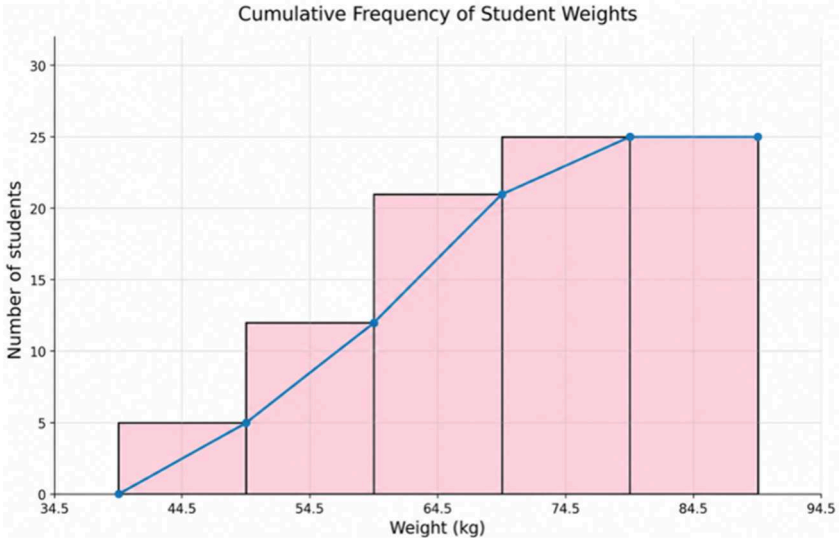

A = odd, B=even, C=even, D=even, E=even, F=odd **2**

Has 2 odd vertices **(1 mark for making a correct statement in regards to vertices)**
Therefore Eulerian **(1 mark for identifying Eulerian)**

**Question 22** (2 marks)

The weights of students in a class were recorded.

The results for this class are displayed in the cumulative frequency graph shown.

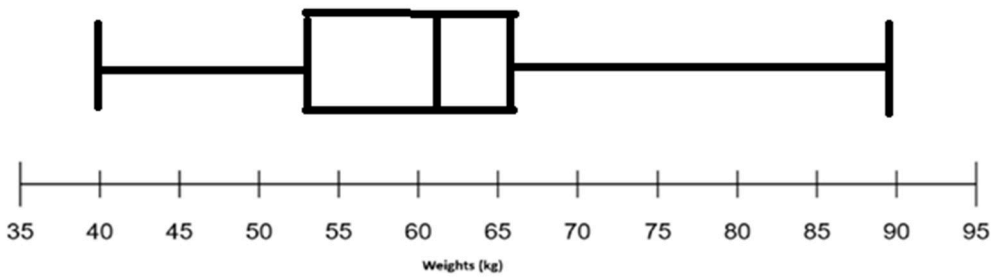



The lightest student in the class weighed 40kg and the heaviest in the class weighed 90kg.

Construct a box-plot for this class in the space below, using a number line **2**

Q1 = 54
Median = 61
Q3 = 66

**(1 mark for correct values Q1, Med, Q3)**

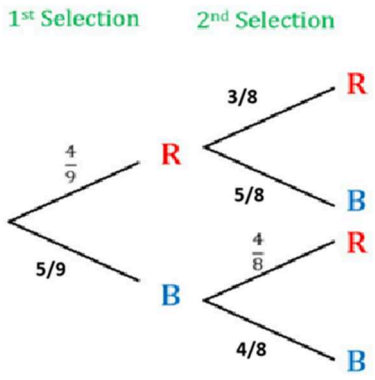



**(1 mark for correct boxplot drawn)**

**Question 23** (4 marks)

A bag contains 4 red balls and 5 black balls. Two balls are selected at random without replacement.

A partially completed tree diagram is shown below.




Complete the probability tree diagram and calculate the probability of selecting two balls of the same colour. **4**

**(1 mark for correct 1st selection branches)**
**(1 mark for correct 2ns selection branches)**

$P(RR\ or\ BB) = P(RR) + P(BB)$
$P(RR\ or\ BB) = \frac{4}{9} \times \frac{3}{8} + \frac{5}{9} \times \frac{4}{8}$ **(1 mark for adding the two options)**

$P(RR\ or\ BB) = \frac{1}{6} + \frac{5}{18}$
$P(RR\ or\ BB) = \frac{4}{9}$ **(1 mark for the correct probability)**

**Question 24** (3 marks)

Sonya and James each invest $2000 for 10 years.

- Sonya's investment earns simple interest at a rate of 5.5% per annum.
- James' investment earns an interest rate of 4.5% per annum, compounding quarterly.

By calculating the interest earned over the 10 years, determine who will have the greater amount. **3**

Sonya
$I = 2000 \times 0.055 \times 10$
$I = \$1100$ **(1 mark for Sonya's correct interest amount)**

James
$FV = 2000 \times (1 + \frac{0.045}{4})^{10\times4}$
$FV = \$3128.75$
$Interest = 3128.75 - 2000$
$Interest = \$1128.75$ **(1 mark for James' correct interest amount)**
$\therefore James\ has\ the\ greater\ amount\ of\ money$
**(1 mark for correct statement of who has greater money)**

**Question 25** (3 marks)

A bowl of hot soup is cooling on a table Its temperature, $T°C$, after $t$ minutes is given by the formula $T = 100(1.075)^{-t}$.

(a) Calculate the temperature of the soup after 2.5 minutes. **1**

$T = 100 \times (1.075)^{-2.5}$
$T = 83.46°C$ (2 d.p) **(1 mark for correct answer)**

(b) What is the vertical intercept of this function and what does it represent? **2**

$let\ t = 0$
$T = 100 \times (1.075)^{0}$
$T = 100°C$ **(1 mark for correct intercept)**

It represents the temperature at the beginning. **(1 mark for correct statement about intercept)**

**Question 26** (3 marks)

Jack and Jill are going to the beach 5km away. Jill will ride her bike at 12km/h while Jack will jog at 8km/h. How much head start should Jill give Jack so that they arrive at the beach at the same time? **3**

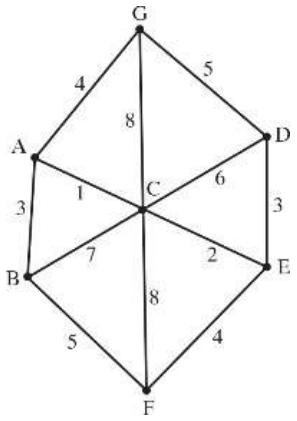
Jack
$t = \frac{d}{s}$
$t = \frac{5}{8}$
$t = 0.625hours$ or 37.5mins **(1 mark for Jack's correct time)**

Jill
$t = \frac{5}{12}$
$t = 0.4167hours$ $or\ 25mins$ **(1 mark for Jack's correct time)**

Difference = 37.5 – 25 = 12.5mins headstart
**(1 mark for correct headstart amount, based off student answers)**

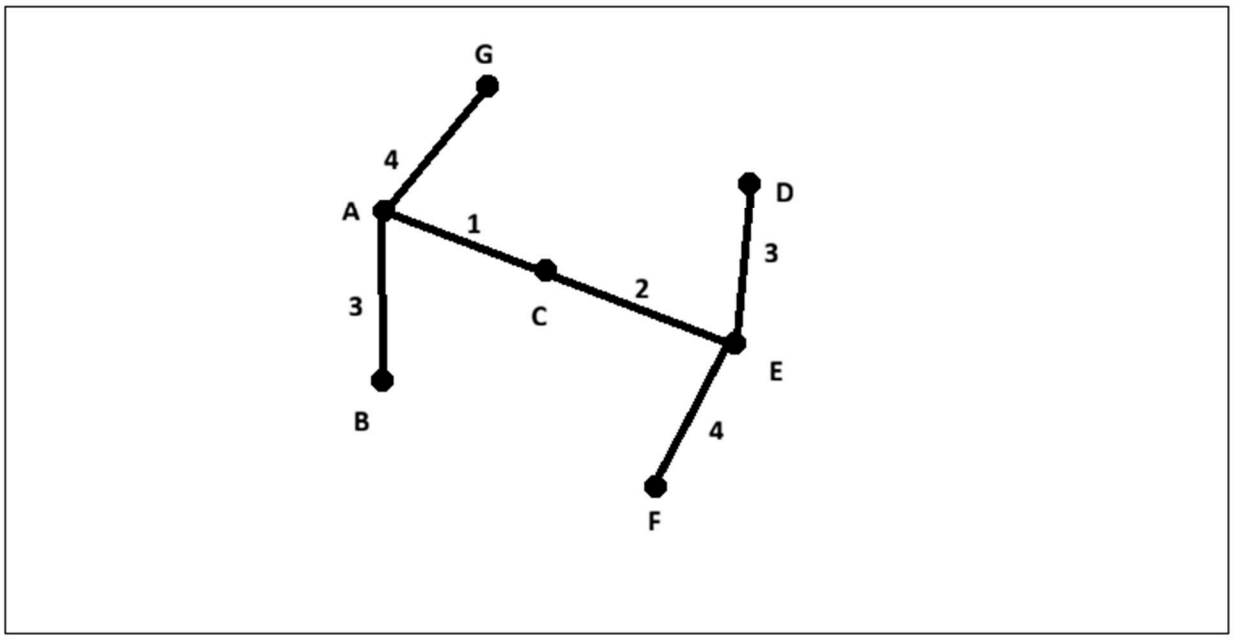
**Question 27** (3 marks)

The graph to the right represents the length in km between seven towns. The towns must be connected by power lines which cost \$700,000 per kilometre. The towns only need to be linked by one line – the entire network is not being constructed.




(a) Draw a minimum spanning tree connecting all 7 towns. **1**

**(1 mark for correct minimum spanning tree)**




b) What is the minimum cost of connecting the towns? Justify your decision mathematically. **2**

$$Length = 4 + 1 + 3 + 2 + 3 + 4 = 17$$

**(1 mark for correct length)**

$$Cost = 17km \times \$700000 = \$11{,}900{,}000$$

**(1 mark for correct cost)**

**Question 28** (4 marks)

The following formula can be used to calculate an estimate for blood alcohol content (BAC) for females.

$$BAC_{\text{Female}} = \frac{10N - 7.5H}{5.5M}$$

Where,

$N$ is the number of standard drinks consumed

$H$ is the number of hours drinking

$M$ is the person's weight in kilograms.

Samantha weighs 65kg. Her BAC was zero when she began drinking alcohol. At 10:00pm, after consuming 4 standard drinks, her BAC was 0.04.

Using the formula, estimate at what time Samantha began drinking alcohol, to the nearest minute. **4**

$0.04 = \frac{(10\times4-7.5\times H)}{(5.5\times65)}$ **(1 mark for correct substitution)**

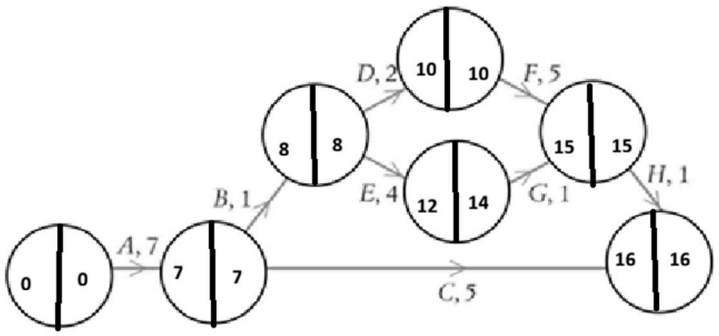
$0.04 = \frac{(10 \times 4 - 7.5 \times H)}{(5.5 \times 65)}$
$0.04 \times 357.5 = 40 - 7.5H$
$14.3 = 40 - 7.5H$ **(1 mark for correct rearranging to find answer)**
$14.3 - 40 = -7.5H$
$\frac{-25.7}{-7.5} = H$

$H = 3.4267 hours$
$H = 3 hours\ 26 mins$ **(1 mark for correct amount of hours)**

10:00pm – 3hr26min = 6:34pm
Therefore, Sam started drinking at 6:34pm.
**(1 mark for correct start time based off student answer)**

**Question 29** (3 marks)

Use forward and backward scanning to identify the critical path. **3**




A, B, D, F, H is the critical path **(1 mark for correct critical path)**

**(1 mark for correct forward scanning)**
**(1 mark for correct backward scanning)**

**Question 30** (2 marks)

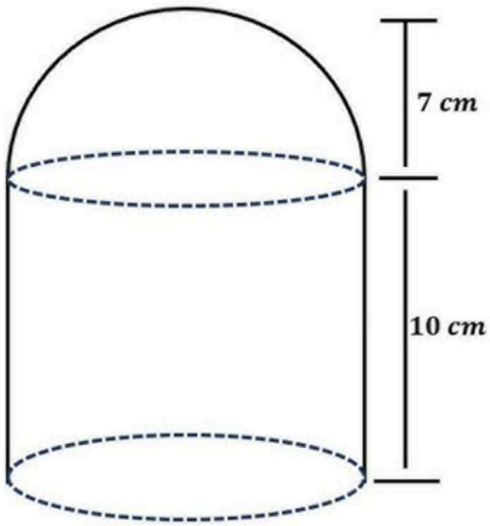
The marks, $x$, obtained by students in a maths exam were normally distributed with a mean of 85 and a standard deviation of 4. If the top 2.5% of students received an A, what was the minimum score to achieve an A? **2**

Top 2.5% $is\ a\ Z > 2$

$2 = \frac{x-85}{4}$ **(1 mark for correct substitution into formula)**
$8 = x - 85$
$x = 93$ **(1 mark for correct minimum score)**
Minimum score is 93.

**Question 31** (3 marks)

A cake is created using a cylinder and a hemisphere shaped top. The cylinder has a height of 10 cm and the hemisphere has a radius of 7 cm.

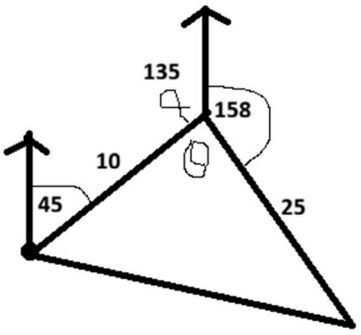



Calculate the surface area of the cake that is to be covered in icing (not including the base), correct to the nearest $cm^2$. **3**

$TSA = 2\pi rh + 2\pi r^2$ **(1 mark for correct use of cylinder and sphere rule)**
$TSA = 2 \times \pi \times 7 \times 10 + 2 \times \pi \times 7^2$ **(1 mark for correct substitution)**
$TSA = 439.823 + 307.876$
$TSA = 747.70$
$TSA \approx 748cm^2$ **(1 mark for correct answer based on formula)**

**Question 32** (3 marks)

An oil tanker hits a reef in the Pacific ocean and releases oil from its reservoirs. The oil slick extends 10km NE from the tanker and from the air can be seen to turn 158° for 25km then back to the tanker. Calculate the area of the oil slick.




$\alpha = 180 - 45 = 135°$ $(co - interior)$ **3**
$\theta = 360 - 158 - 135 = 67°$ $(1\ revolution)$

**(1 mark for finding included angle)**

$A = \frac{1}{2}bcsinA$
$A = \frac{1}{2} \times 10 \times 25 \times sin67$ **(1 mark for substitution into area formula correct)**
$A = 115.06km^2$ **(1 mark for correct area)**

**Question 33** (3 marks)

A full container has 5.2 L of a mixture of cordial and water in the ratio 1 : 3. After removing 1.6 L of the mixture, more water is added to refill the container. What is the ratio of cordial to water in the final mixture? **3**

$Remaining\ mix = 5.2 - 1.6 = 3.6L$

$1\ part\ remaining = \frac{3.6}{4} = 0.9L$

$c : w$
0.9 : 2.7 **(1 mark for identifying ratio for remaining mixture)**
(w+1.6)
0.9 : 4.3 **(1 mark for identifying ratio with water added in decimal form)**
09 : 43 **(1 mark for identifying final ratio of mixture)**

Ratio of final mixture is 9:43 of cordial to water.

**Question 34** (6 marks)

Joanne borrowed $595 000 to buy a house. The loan is to be repaid over 25 years at a rate of 6.25% per annum, compounded monthly. The repayments have been set at $3 925 per month.

The interest charged and the balance owing for the first four months of the loan are shown in the spreadsheet below.

| Month | Principal (at start of month) | Interest charged | Monthly repayment | Balance (at end of month) |
|---|---|---|---|---|
| 1 | $595 000 | $3 098.96 | $3 925 | $594 173.96 |
| 2 | $594 173.96 | A | $3 925 | $593 343.62 |
| 3 | $593 343.62 | $3 090.33 | $3 925 | $592 508.95 |
| 4 | $592 508.95 | $3 085.98 | $3 925 | B |

(a) Some values in the table are missing. Write down the values for A and B. **2**

$A = \frac{0.0625}{12} \times 594173.96$
$A = \$3094.66$ **(1 mark for correct A value)**

$B = 592508 + 3085.98 - 3925$
$\boldsymbol{B} = \$591669.93$ **(1 mark for correct B value)**

(b) What is the total to be repaid over the 25 years? **1**

$Total\ repaid = 3925 \times 25 \times 12$
$Total\ repaid = \$1177500$ **(1 mark for correct total repaid)**

(c) After 10 years of repaying the loan, Joanne decides to make a lump sum payment of $100 000 and to continue making monthly repayments of $3 925. The loan will then fully be repaid after a further 132 monthly repayments.

Using your answer from part (b), calculate how much less Joanne will pay overall by making the lump sum payment. **3**

$Total\ (lump\ sum) = 100000 + (120 + 132) \times 3925$ **(1 mark for correct working)**
$Total\ (lump\ sum) = \$1{,}089{,}100$ **(1 mark for correct total repaid)**

$Savings = 1177500 - 1089100$
$Savings = \$88400$ **(1 mark for correct savings)**

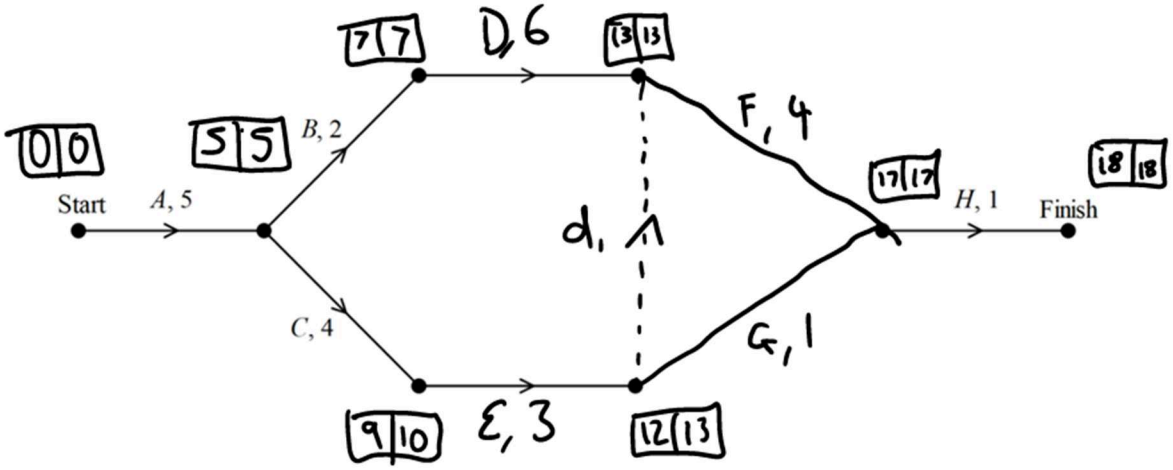
She will save $88400 by paying the lump sum payment.

**Question 35** (5 marks)

The drama department at a school is planning a school musical production. The following table outlines the key activities, their durations and which activities must be completed before others can begin.

| Activity | Description | Duration (weeks) | Predecessor(s) |
|---|---|---|---|
| *A* | Write script | 5 | — |
| *B* | Audition cast | 2 | *A* |
| *C* | Design set and costumes | 4 | *A* |
| *D* | Cast rehearsals | 6 | *B* |
| *E* | Build set and create costumes | 3 | *C* |
| *F* | Rehearse with full staging | 4 | *D, E* |
| *G* | Technical setup (lighting/sound) | 1 | *E* |
| *H* | Final dress rehearsal | 1 | *F, G* |

(a) Complete the network diagram for the school musical production. **2**




**(1 mark for correctly finished and labelled graph)**
**(1 mark for correct dummy line)**

(b) Determine the minimum time needed to complete the project. **1**

Time needed is 18 weeks **(1 mark for correct time)**

(c) What is the float time for Activity E? **1**

$Float\ time = 13 - 9 - 3 = 1 week$ **(1 mark for correct float time)**

(d) Activity C is delayed by 3 weeks causing a delay to the entire production. By how many weeks is the overall production delayed? **1**

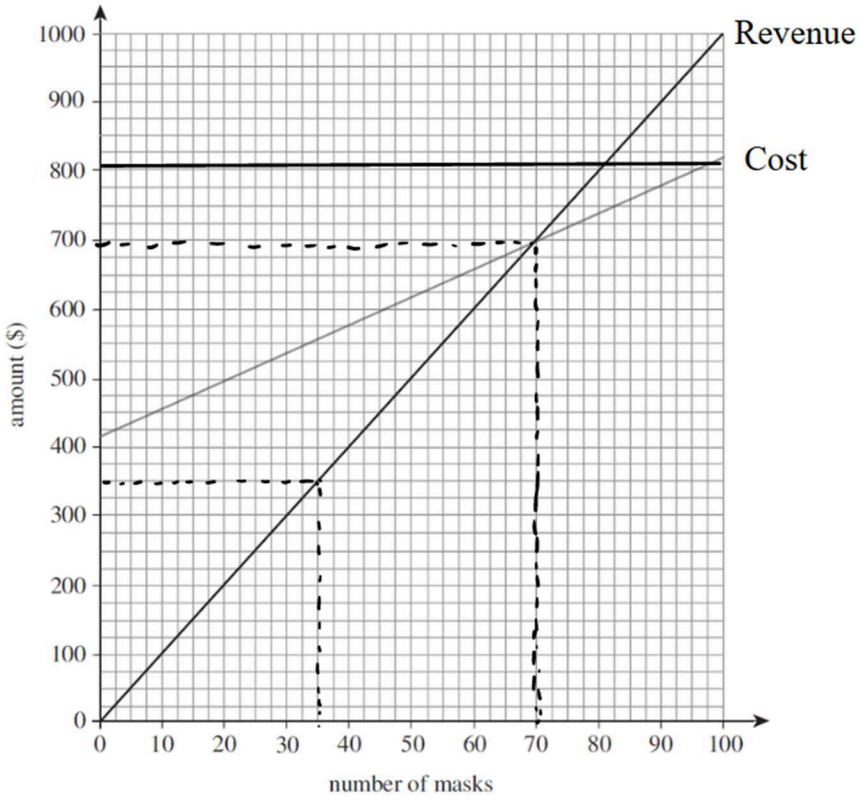
2 weeks as Activity C already had a Float time of 1 week. **(1 mark for correct delay time)**

**Question 36** (5 marks)

Willow's business Fashion Face Masks makes and sells embroidered face masks. Willow purchases plain cloth masks and embroiders them with different patterns.

The cost of each plain mask is \$4 and Willow sells the embroidered masks for \$10 each.
Willow invests \$420 in an embroidery machine and a thread kit to make 100 masks.

The production cost and revenue generated from the sale of the embroidered masks can be modelled with two linear equations, as shown in the graph.




(a) Using the graph, solve the two equations simultaneously and explain the significance of this solution for Willow's business. **2**

*Using the graph,* $n = 70$ *and amount is* \$700 $(70, 700)$ **(1 mark for correct point)**
This is the breakeven point for cost to equal revenue. **(1 mark for correct explanation)**

(b) How many masks does Willow need to sell to obtain a revenue of $350. **1**

$When\ revenue\ is\ \$350, number\ of\ masks\ is\ 35.$ **(1 mark for correct number of masks)**

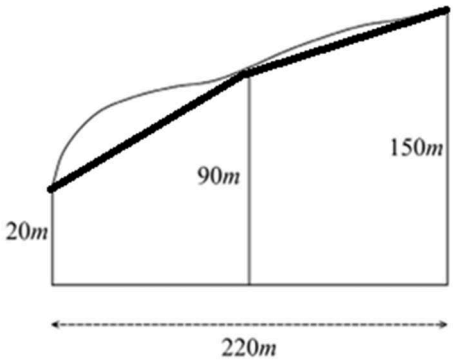
(c) How much profit does Willow make if she sells 100 masks? **2**

$Revenue = \$1000$
$Cost = \$4 \times 100 + 420 = \$820$ **(1 mark for both correct revenue and cost amounts)**

$Profit = \$1000 - 820$
$Profit = \$180$ **(1 mark for profit worked out correctly)**

**Question 37** (3 marks)

The diagram below shows a survey of the land that Josie will build her house on.




(a) Use two applications of the trapezoidal rule to estimate the area of land to the nearest whole number. **2**

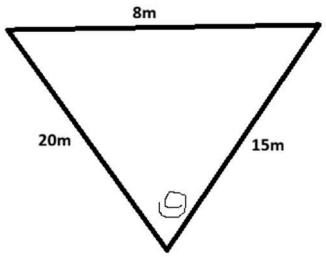
$A \approx \frac{110}{2}(20 + 90) + \frac{110}{2}(90 + 150)$ **(1 mark for correct substitution for two applications)**
$A \approx 6050 + 13200$
$A \approx 19250m^2$ **(1 mark for correct area)**

(b) Do you think your approximation in part (a) is higher, lower, or about equal to the actual area of this land? Provide reasons for your decision. **1**

Approximation is lower than the actual area as the trapezium doesn't account for some of the area.
**(1 mark for correct statement)**

**Question 38** (2 marks)

A soccer goal is 8m wide. A player shoots for goal when he is 20m from one post and 15m from the other post. Within what angle must the shot be made to score a goal? **2**




$cos\theta = \frac{20^2+1\ ^2-8^2}{2\times20\times15}$ **(1 mark for correct substitution into cosine rule)**

$cos\theta = 0.935$
$\theta = \cos^{-1}(0.935)$

$\theta = 20.77°$ $(2\ d.p)$ **(1 mark for correct angle based off substitution)**

**Question 39** (3 marks)

The table shows the income tax rate for Australian residents for the 2025 – 2026 financial year.

| Taxable income | Tax on this income |
|---|---|
| 0 – $18,200 | Nil |
| $18,201 – $45,000 | 16c for each $1 over $18,200 |
| $45,001 – $135,000 | $4,288 plus 30c for each $1 over $45,000 |
| $135,001 – $190,000 | $31,288 plus 37c for each $1 over $135,000 |
| $190,001 and over | $51,638 plus 45c for each $1 over $190,000 |

At the end of the 2025 – 2026 financial year, Kale's tax payable was $154 536, excluding the medicare levy.

What was Kale's taxable income? **3**

Would need to be in the highest tax bracket to pay that much tax.

$154536 = 51638 + 0.45 \times (x - 190000)$ **(1 mark for correct substitution into correct bracket)**
$102898 = 0.45 \times (x - 190000)$
$\frac{102989}{0.45} = x - 190000$

$228662.22 = x - 190000$ **(1 mark for correct rearranging based off bracket chosen)**
$228662.22 + 190000 = x$
$\$418{,}662.22 = x$ **(1 mark for correct answer based bracket chosen)**

**Question 40** (2 marks)

Sam believes he did better on his Math exam than his Physics exam. The Physics exam had a mean score of 55 and a standard deviation of 17 and he achieved 67 out of 100. On the Math exam, he achieved 72 out of 100 and the class had a mean of 64 and a standard deviation of 12. Evaluate the reasonableness of Sam's statement, using mathematical reasoning. **2**

$z(physics) = \frac{67 - 55}{17}$

$z(physics) = 0.71$

$z(math) = \frac{72 - 64}{12}$

$z(math) = 0.67$ **(1 mark for both z-scores correct)**

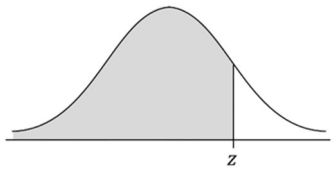
$\therefore Sam\ is\ incorrect, he\ did\ better\ on\ Physcis\ in\ relation\ to\ the\ other\ students\ as\ he\ has\ a\ higher\ z - score.$

**(1 mark for correct statement based off z-scores)**

**Question 41** (2 marks)

A random variable is normally distributed with mean 0 and standard deviation 1. The table below gives the probability that this random variable lies below $z$ for different values of $z$.

| z | .0 | .1 | .2 | .3 | .4 | .5 | .6 | .7 | .8 | .9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.500 | 0.540 | 0.579 | 0.618 | 0.655 | 0.691 | 0.726 | 0.758 | 0.788 | 0.816 |
| 1 | 0.841 | 0.864 | 0.885 | 0.903 | 0.919 | 0.933 | 0.945 | 0.955 | 0.964 | 0.971 |




**2**

A manufacturer produces luxury scented candles. The mass of wax in each candle is normally distributed with a mean of 300 grams and a standard deviation of 4 grams.
What percentage of candles would you expect to contain more than 302 grams of wax?

$z = \frac{302 - 300}{4}$

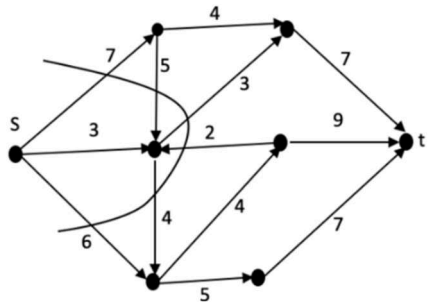
$z = 0.5$

$P(z > 0.5) = 1 - 0.691$ **(1 mark for correct probability based off z-score of 0.5)**
$P(z > 0.5) = 0.309$
$P(z > 0.5) = 30.9\%$ **(1 mark for correct percentage)**

**Question 42** (4 marks)

A plumber needs to fix a system of pipes. The sink ($t$)is connected to the water source ($S$) by an interconnected series of one-directional pipes. The capacity of each pipe is shown below.

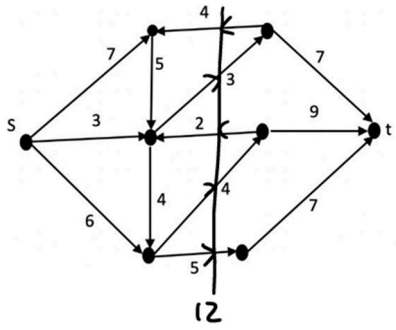
(a) What is the capacity of the cut below? **2**

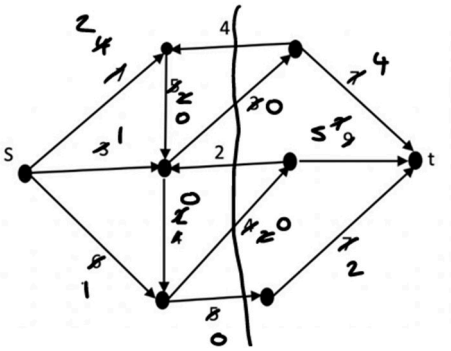



$Capacity = 7 + 3 + 4 + 6$ **(1 mark for correct substitution)**

$Capacity = 20$ **(1 mark for correct capacity of cut)**

(b)The plumber experienced difficulty in cutting the pipes and wants to identify the smallest cut possible (in terms of capacity). By finding the maximum flow, explain why this is the smallest cut possible. Justify your response on the diagram below. **2**




$Smallest\ cut = 3 + 2 + 2 + 5 = 12$ **(1 mark for maximum flow)**

The cut goes through all the zero edges or the edges flowing the wrong way.
**(1 mark for drawing the smallest cut)**

**End of Examination**