Gosford High School

2024 | 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 16-34
- Allow about 2 hours and 5 minutes for this section

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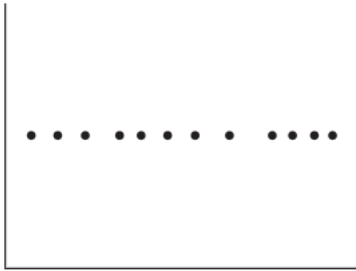**Attempt Questions 1 – 15**
Allow about 25 minutes for this section

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

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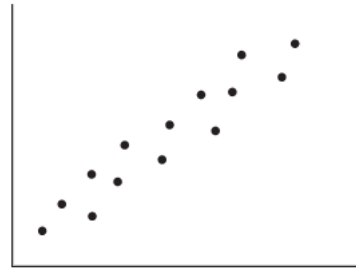**1**   Which of the following data sets would have a correlation coefficient closest to 1?

A.

B.

C.

D.

2   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.   Nominal categorical

    D.   Ordinal categorical

3 Which equation correctly shows S as the subject of $25P = 50\pi(R - \dfrac{S}{2})$

A. $S = \dfrac{P}{\pi} - 2R$

B. $S = \dfrac{P}{\pi} - R$

C. $S = 2R - \dfrac{P}{\pi}$

D. $S = \dfrac{P}{4\pi} - \dfrac{R}{2}$

4 The following boxplots show the distribution of the height of babies born in two different countries, country A and country B.
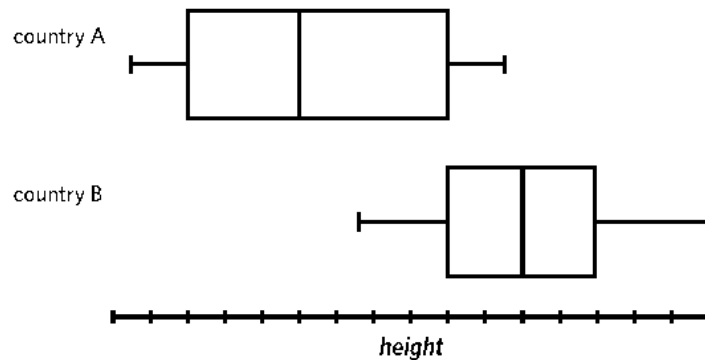
Based on the boxplots shown, it can be said that

A. 50% of the babies born in country B are taller than all of the babies born in country A.

B. 50% of the babies born in country B are shorter than all of the babies born in country A.

C. 75% of the babies born in country A are shorter than all of the babies born in country B.

D. 75% of the babies born in country B are taller than all of the babies born in country A.

4

5   Claire measured her height as 1.65 m, correct to the nearest centimetre. What is the percentage error in her measurement?

    A.   0.003%

    B.   0.006%

    C.   0.3%

    D.   0.6%

6   In a raffle, the total prize money is shared among the first three tickets drawn in the ratio 4 : 3 : 2.

The prize for the second ticket drawn is $750.

What is the total prize money?

    A. $150

    B. $1 000

    C. $2 250

    D. $2 500

7   A survey of 120 students was conducted. They were asked their gender and if they played a sport. The results are summarised in the table below.

	Male	Female	Total
Sport	50	30	80
No Sport	15	25	40
Total	65	55	120

A student is selected at random from the males. What is the probability that the student selected plays a sport?

    A. $\dfrac{5}{12}$

    B. $\dfrac{5}{8}$

    C. $\dfrac{13}{24}$

    D. $\dfrac{10}{13}$

8   A network contains 30 vertices. How many edges are required to form a spanning tree?

   A.   14

   B.   15

   C.   29

   D.   30

9   The diagram shows a triangle ABC where $AC = 44cm$, $AC = 27cm$, $\angle BCA = 32°$ and angle ABC is obtuse.
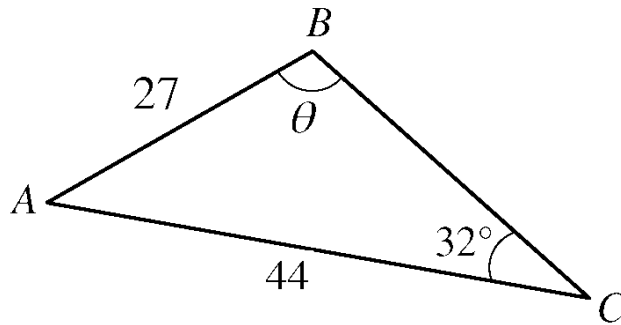
   What is the size of the obtuse angle ABC to the nearest degree?

   A.   51°

   B.   60°

   C.   120°

   D.   129°

10   The length of a string on a musical instrument varies inversely to its frequency vibration. A 32.5 cm string on a violin has a frequency vibration of 400 cycles per second. What would be the frequency vibration of a 25 cm string?

   A.   16

   B.   308

   C.   520

   D.   13000

11 Which of the following graphs represent the graph $y = 5(0.9)^x$
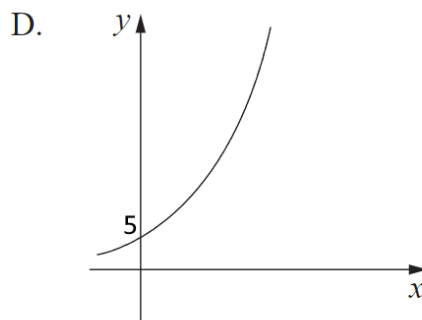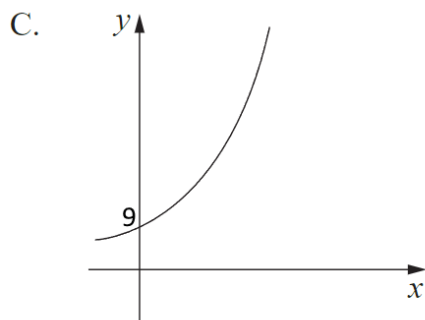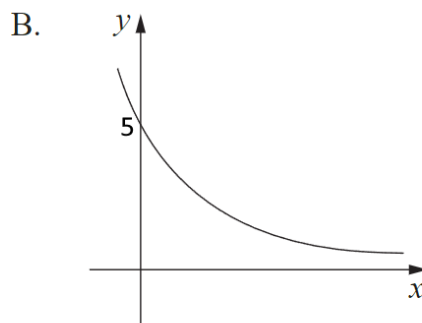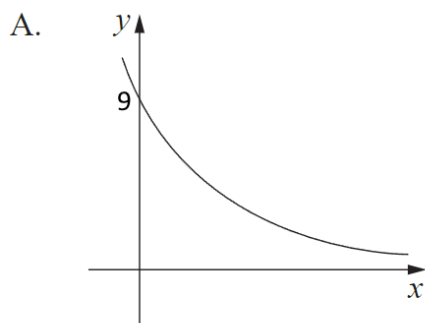
A.

B.

C.

D.

12 Linley flew from Sydney (UTC+ 10) to Rio de Janeiro (UTC- 3). Her plane left Sydney at 8:30 a.m. Thursday (Sydney time) and arrived in Rio de Janeiro at 2:00 p.m. Thursday (Rio de Janeiro time).

What was the total flying time?

A. 5 hours 30 minutes

B. 12 hours 30 minutes

C. 14 hours 30 minutes

D. 18 hours 30 minutes

13 There were total of 22 400 people who flew on the USS Enterprise D. The ratio of passengers to crew was 6 : 29. When the starship was crashing on Veridian III, all of the passengers were able to evacuate while 3 200 of the crew did not evacuate.

For those who evacuated, what is the ratio, in its simplest form, of passengers to crew?

A. 1 : 4

B. 1 : 35

C. 5 : 6

D. 6 : 5

14 The IQs of 80 Gosford High School teachers are normally distributed with a mean of 108 and a standard deviation of 6.3.

How many teachers are expected to have an IQ of more than 120.6?

A.   2

B.   13

C.   67

D.   78

15 What is the capacity of the cut shown in the directed graph below?

A.   36

B.   42

C.   52

D.   68
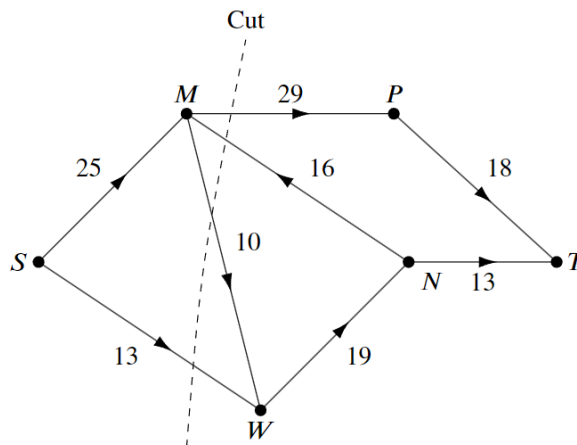
Mathematics Standard 2

Section II Answer Booklet

Section II

85 marks

Attempt Questions 16–34

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 at the back of this booklet. If you use this space, clearly indicate which question you are answering

Question 16 (5 marks)

Sol purchased a new car for $52 000. It depreciated initially by using straight-line depreciation for the first 4 years at a rate of $2 000 per year.

(a) Calculate the value of the car at the end of the fourth year. **1**

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(b) After the fourth year, Sol changed the method of depreciation to the declining balance method at the rate of 18% per annum. **2**

Calculate the value of the car ten years after it was purchased

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(c) Without further calculations, complete the graph below to show the value of the car over 10 years **2**
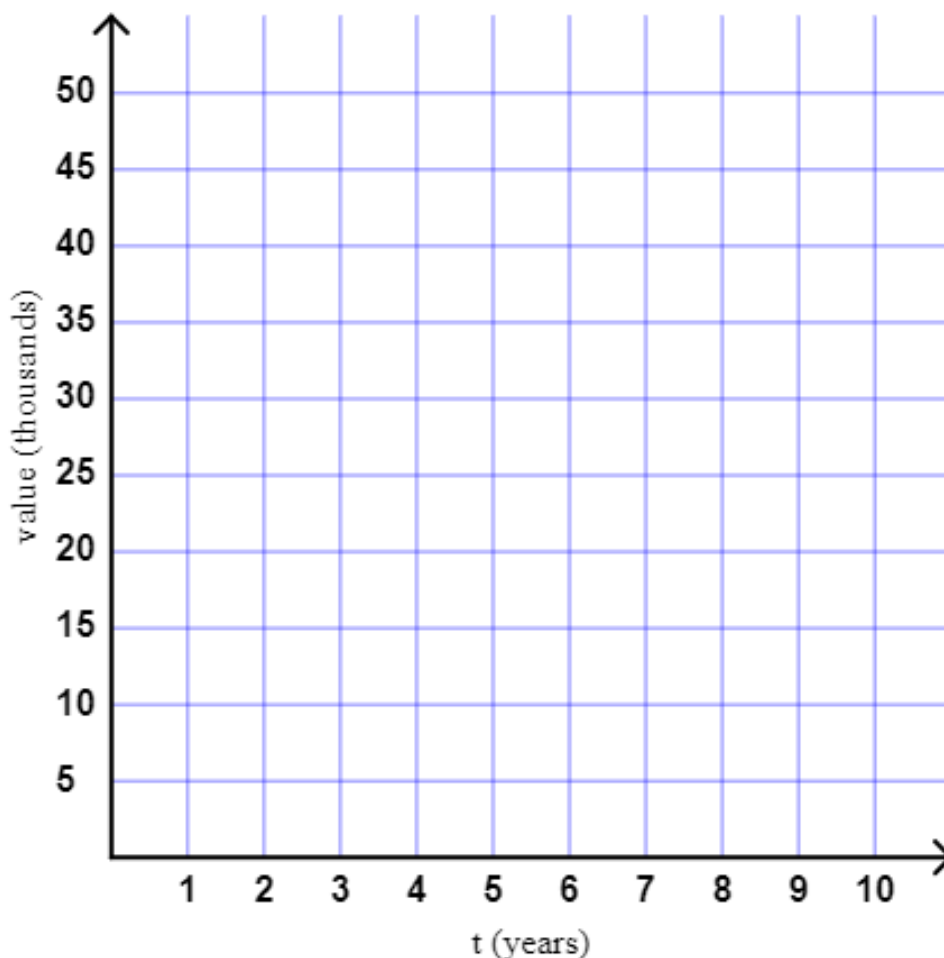
Question 17 (4 marks)

Mr Eveleigh collated information about reasons that his students were late to his class over a period of 1 term.

The data is displayed in a Pareto chart below. The column showing the number of students late due to looking at the wrong day on their timetable has been removed from the chart.

Late Excuse 2024
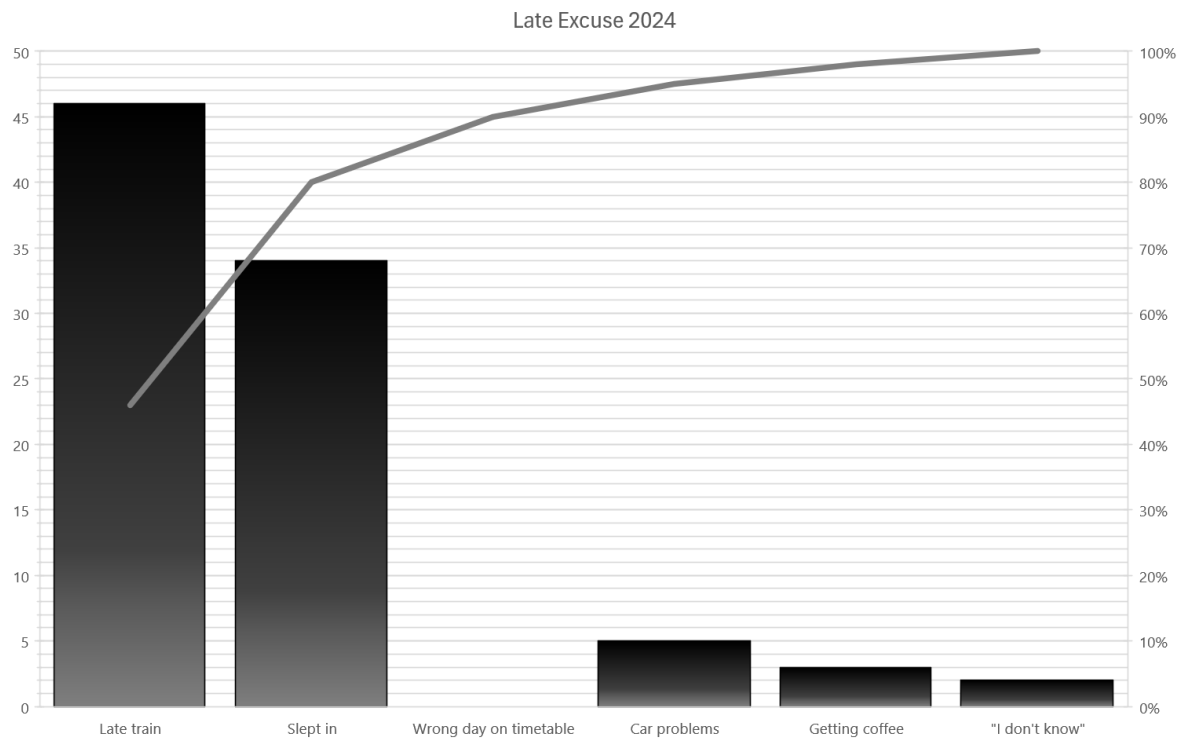
(a) How many students claimed they were late due to getting coffee? **1**

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(b) What percentage of students were late due to a late train or sleeping in? **1**

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(c) How many students were late due to looking at the wrong day on their timetable? **2**

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Question 18 (4 marks)

Joel sits a Mathematics test and Business Studies test.

(a) Joel's mark in the Mathematics test is 76. The mean mark for this test is 82 and the standard deviation is   **2**
6.

Joel's z-score is the same in both the Mathematics tests and the Business Studies test.

In the business studies test, Joel's mark was 81 and the standard deviation is 3.

What is the mean in the Business Studies test?

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(c) King Business, Joel's Business Studies teacher, realised he left out Jinhyun's marks for his calculations.   **2**
He calculates the new mean to be 85. There are 15 students in the class in total.

What is Jinhyun's mark on the test?

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Question 19 (3 marks)
Yunbin owns a share portfolio. Details of her share portfolio at 30 June 2024 are given in the table.

Company Name	Number of shares in Yunbin's portfolio	Dividend yield (per annum)	Market price per share
ACE	350	4.5%	$6.32
ZAP	50	?	$24.80

Yunbin received a total annual dividend of $188.82 from her share portfolio.

(a) Calculate the total dividend that Yunbin received from ACE on 30 June 2024. **1**

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(b) Calculate the dividend yield of company ZAP on 30 June 2024. **2**

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Question 20 (2 marks)
A compass radial survey of the field ABC has been conducted from O. **2**
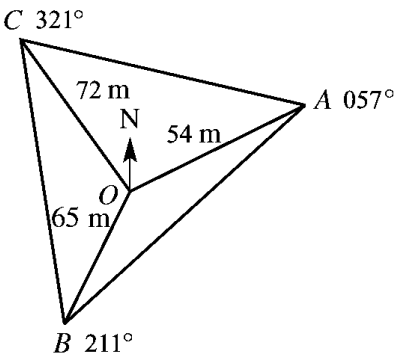
Find the area of the section AOC to the nearest square metre.

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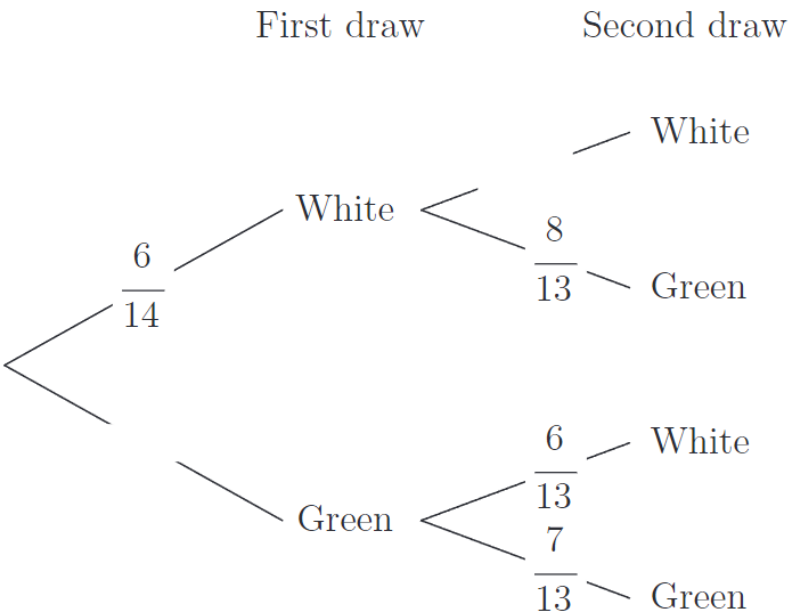
Question 21 (4 marks)
A bag contains 8 green balls and 6 white balls. Two balls are selected at random without replacement.

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A partially completed tree diagram is shown below.

First draw   Second draw

White

$\frac{8}{13}$ Green

White

$\frac{6}{14}$

$\frac{6}{13}$ White

Green

$\frac{7}{13}$ Green

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

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Question 22 (5 marks)

The following scatterplot shows the average attendance figures at home games, plotted against the number of games won in the 2023 NRL season, where teams played 24 games. The line of best fit is also shown.
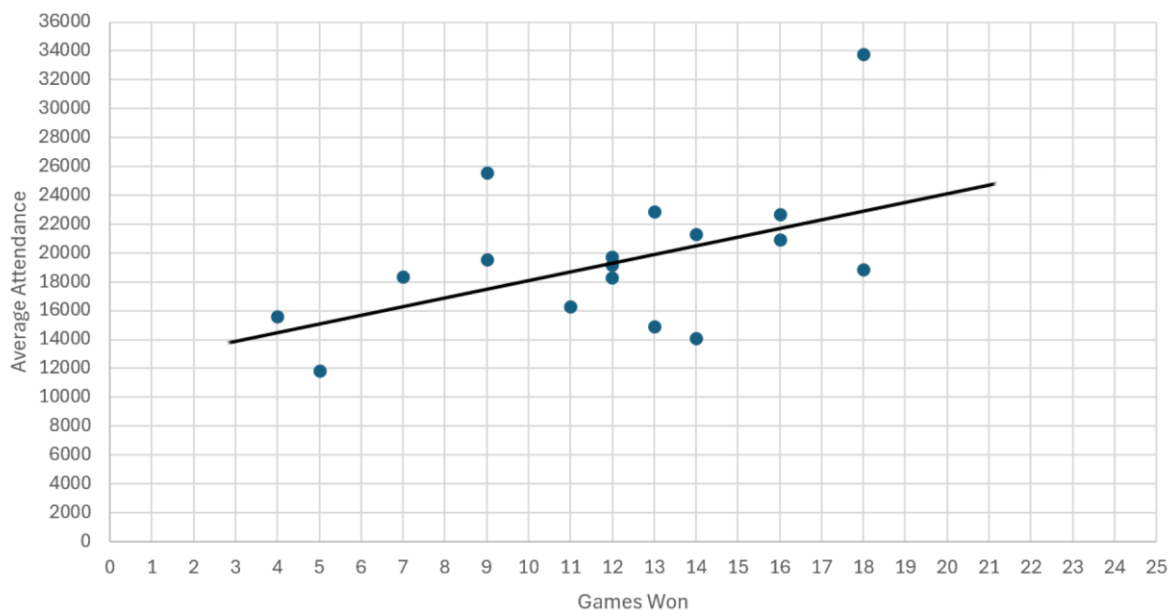
(a) Determine the equation of the line of best fit using the coordinates at 10 games won and 20 games won. **2**

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(b) Interpret the slope of the line of best fit. **1**

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(c) A new team, the Perth Bears, is expected to have an average attendance of 27000. Using the graph, or otherwise, estimate the number of games they are expected to win. **1**

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Question 21 Continues on the next page

(d) Explain why the extrapolation of the Perth Bears average attendance is unreliable. **1**

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Question 23 (4 marks)
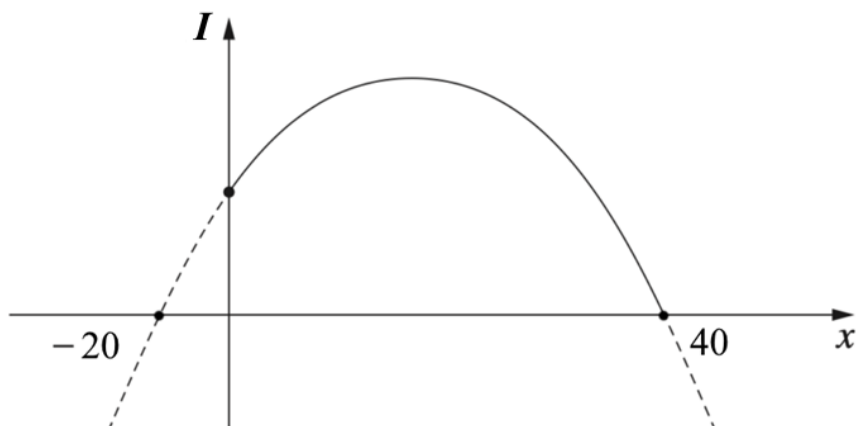Ebony invested $15 500 in an account that earned $2 255 interest after 6 years. The interest was compounded monthly. **4**

Find the annual interest rate as a percentage, correct to 1 decimal place.

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Question 24 (4 marks)

The following formula can be used to calculate an estimate for blood alcohol content (BAC) for males.   **4**

$$BAC_{male} = \frac{10N - 7.5H}{6.8M}$$

N is the number of standard drinks consumed

M is the person's weight in kilograms

H is the number of hours drinking

Mr Kellerman weighs 79 kg. His BAC was zero when he began drinking alcohol. At 11:00 pm, after consuming 2 bottles of wine, his BAC was 0.07. Each bottle of wine has 6.3 standard drinks.

Using the formula, estimate at what time Mr Kellerman began drinking alcohol, to the nearest minute.

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Question 25 (6 marks)

A surveyor provided the following diagram with measurements for the roof of a property in Gosford that she was mapping out.
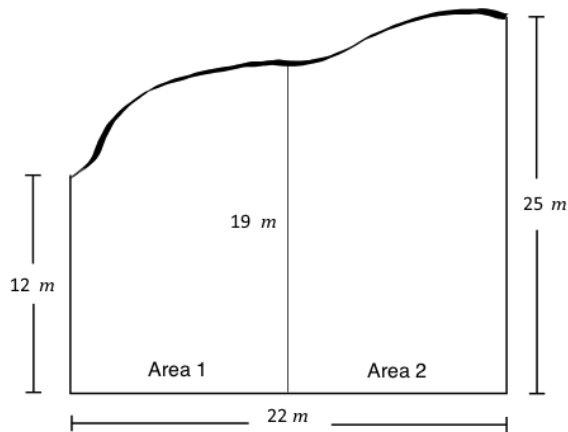
(a) Find the approximate total area of the roof of the property by using two applications of the trapezoidal rule.   **2**

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(b) The surveyor is reading a meteorological report that lists the average monthly rainfall in the Gosford region. According to the report, April sees 75 mm of rainfall on average.   **2**

What volume of rainfall can the surveyor expect to fall over the property next April?

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(c) The rainfall that hits the roof of the property is then collected in a cylindrical tank with a diameter of 360 cm.   **2**

Assuming the tank was empty before the rainfall and that all of the rainfall is directed into the tank, what is the height of the water in the tank after the rainfall? Answer correct to the nearest centimetre.

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Question 26 (7 marks)

Khoi's Kite Kiosk sells kites as a part of his business. He can make a maximum of 30 kites per week. The fixed weekly cost of productions is $\$a$ and the variable cost of production is $\$b$ per kite.

The diagram below shows a graph of Khoi's weekly production costs. The equation of this graph is given by $C = bx + a$.

Planned income and costs for Khoi's business
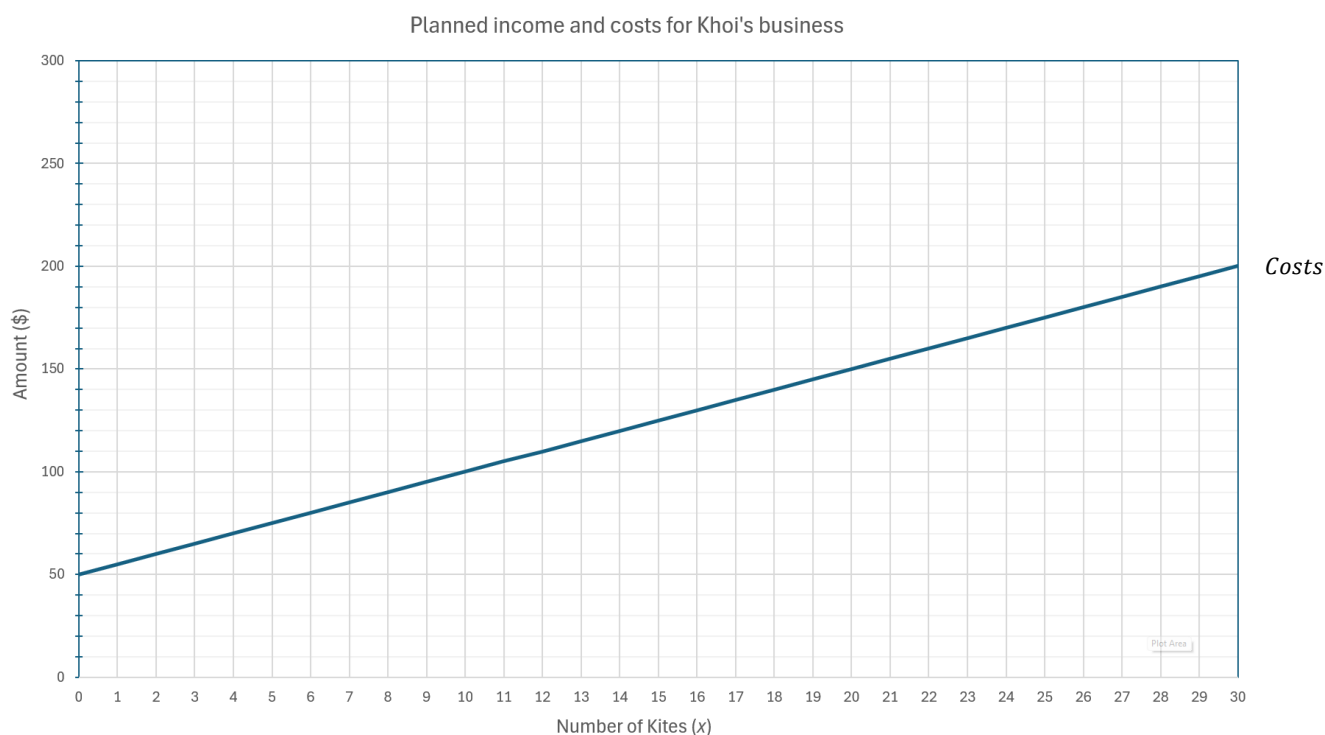
(a) Determine the values of a and b **2**

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(b) Khoi sells his kites for $\$9$ each. Write an equation representing the income $\$I$ made from selling n kites. **1**

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(c) On the diagram above, draw the straight line representing the income equation in (b) **1**

Question 26 continues on the next page

(d) Use the graph to solve the two equations simultaneously for x and explain the significance of this solution for Khoi's business. **2**

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(e) Calculate the how many kites would need to be sold to make a profit of $50 **1**

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Question 27 (4 marks)

Two observers at A and B on horizontal ground are 300 m apart. From A, the angle of elevation of the top C of a tall building DC is 32°. **4**

It is also known that $\angle DAB = 59°$ and $\angle ADB = 78°$.

Find the height of the building, correct to the nearest metre.

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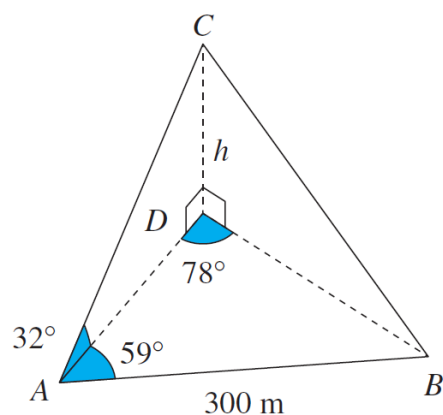
Question 28 (5 marks)

Jessie borrowed $439 000 to buy a house. The loan is to be repaid over 25 years at a rate of 6.2% per annum, compounded monthly. The repayments have been set at $2 882 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	$439 000	$2 268.17	$2 882	$438 386.17
2	$438 386.17	A	$2 882	$437 769.17
3	$437 769.17	$2 261.81	$2 882	$437 148.98
4	$437 148.98	$2 258.60	$2 882	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, Jessie decides to make a lump sum payment of $100 000 and to   **2**
continue making monthly repayments of $2 882. The loan will then fully be repaid after a further 128
monthly repayments.

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

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Question 29 (3 marks)

A random variable is normally distributed with a mean of 0 and a standard deviation of 1. The table gives the probability that this random variable lies below z for some positive values of z. **3**

z	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39
Probability	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177

The probability values given in the table are represented by the shaded area in the following diagram.

The HSC results for Mathematics Standard students at Gosford High School form a normal distribution with mean $\mu = 87.2$, and standard deviation $\sigma = 8.905$.

In a group of 40 students, how many would be expected to score more than 75?

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Question 30 (6 marks)

Hannah's Hat Haberdashery makes and sells hats. She can make and sell 80 hats per week. Each hat currently costs $10.

Hannah is currently selling out of all of her hats every week. She decides to increase the price of the hats to see if she can increase the income earned each week.

It is assumed that for each one dollar increase in hat price, there will be 2 fewer hats sold.

If Hannah charges $(10 + x)$ dollars for each hat, a quadratic model for the income raised, I, from selling hats is $I = -2x^2 + 60x + 800$.

A graph showing this relationship between increase in hat price and the revenue is shown below. The x-intercepts have been labelled.

(a) By first finding a suitable value of x, find the price Hannah should charge for each hat to maximise the income raised from the sales of the hats. **2**

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(b) What is the number of hats sold when the income is maximised? **1**

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Question 30 continues on the next page

24

(c) The cost to Hannah of making each hat is $500 plus $5 per hat. Calculate the profit earned by Hannah when the income earned from each hat is maximised. **2**

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(d) Find the value of the intercept of the parabola with the vertical axis. **1**

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Question 31 (3 marks)
The capture-recapture technique was used to estimate a population of duckbill platypus. **3**

In 2020, 36 platypuses were caught, tagged and released.

2 years later, in 2022, some platypuses were captured in the same area. Eight of these were found to be tagged, which was 40% of the total captured during 2022.

Calculate the estimate for the total population of platypus in this area.

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Question 32 (3 marks)

The table shows the income tax rates for the 2023-2024 financial year. **3**

Taxable Income	Tax on this income
0 - $18 200	Nil
$18 201 - $45 000	19c for each $1 over $18 200
$45 001 - $120 000	$5 092 plus 32.5c for each $1 over $45 000
$120 001 - $180 000	$29 467 plus 37c for each $1 over $120 000
$180 001 and over	$51 667 plus 45c for each $1 over $180 000

The Medicare levy is calculated as 2% of taxable income.

For the 2022-2023 financial year, Lachlan pays a Medicare levy of $3 193.10.

Calculate the tax payable on Lachlan's taxable income.

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Question 33 (5 marks)

Consider the activity network below. Forward and backwards scanning has been partially completed.

| 4 | 8 |

D, 3

| 10 | 12 |

B, 3

dummy

E, 4

G, 3

| 0 | 0 |

A, 1

| 1 | 1 |

| | | I, 4

Start

| 6 | 8 |

H, 4

Finish

C, 5

dummy

J, 3

| 6 | 6 |

F, 5

| 11 | 11 |
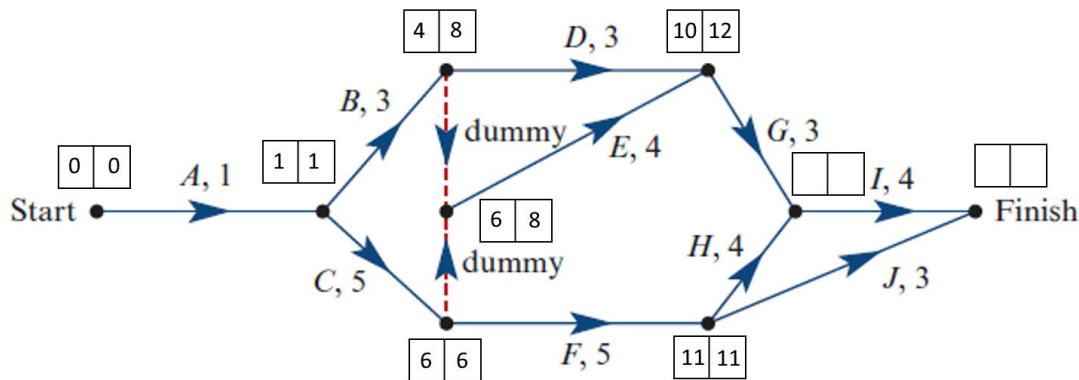
(a) By completing the scanning on the network above, state the minimum completion time for the project   **1**

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(b) State the critical path   **1**

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(c) By employing more workers, it is possible to reduce the time of some activities. However, this will incur extra costs. The activities which can be reduced in time, the associated costs and maximum reduction in time are shown in the table below.   **2**

Activity	Cost (dollars per week)	Maximum reduction (weeks)
E	1000	2
F	1500	3
H	2000	3
J	200	2

What is the new minimum completion time now possible for the project?

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(d) What is the minimum cost of completing the project in this time?   **1**

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Question 34 (8 marks)

Shanon is a truck driver who frequently travels between Melbourne and Sydney. She has drawn a network diagram, as shown below, with all of the major towns as vertices and the major roads between those towns as edges. The weights on the edges represent the distance along the roads between the towns, in kilometres.
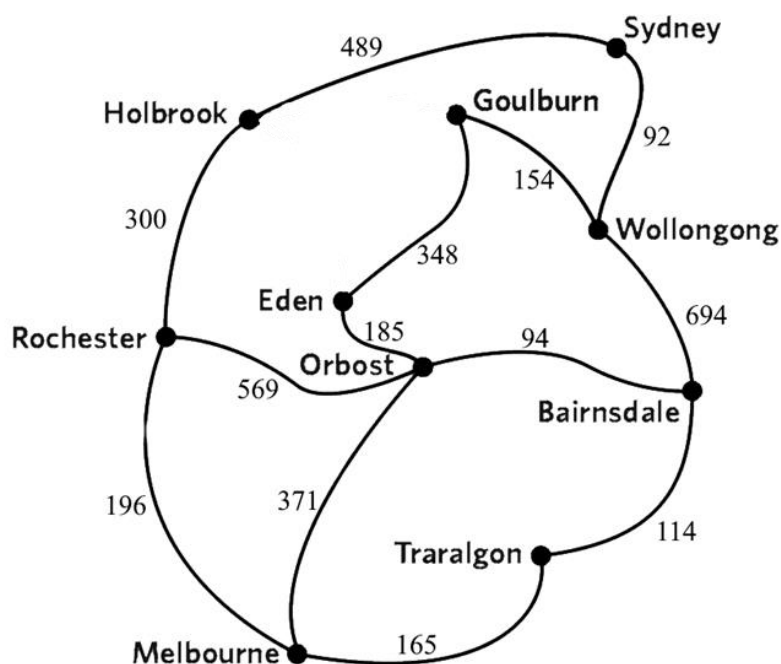
(a) Shanon wants to travel from Melbourne to Sydney in the shortest distance possible to save on fuel costs. **2**

Describe the possible path she can take and the total distance she must travel.

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(b) Shanon's truck uses fuel at the rate of rate of 8.8 L/100 km on average for this trip. The cost of fuel is $1.87/L. **2**

How much does the shortest path cost her in fuel?

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Question 34 Continues on the next page

(c) Shanon wants to upgrade to an electric truck to take advantage of the solar panel's that she has on her home. **4**

Shanon's current daily electricity usage is 18.5 kWh. Charging the truck would take an extra 22.6 kWh. She has a solar panel system which generates 55 kWh of energy per day, exporting any unused energy to the grid. Shanon's energy retailer charges $0.235 per kWh and pays $0.10 per kWh for energy exported to the grid.

What is Shanon's total daily financial benefit of having the solar panel system, correct to the nearest cent?

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End of Paper

MC	Multiple Choice Solutions

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

1	Which of the following data sets would have a correlation coefficient closest to 1?

A.

B.

C.

D.

Solution

Correlation coefficient of 1 will have a positive gradient and be tightly clustered.

= B

2	Joseph is a personal trainer. He records his client's weight as part of his training regime. How can this data be classified?

Solution

Weight is represented as a number that can be measured. This is a continuous numerical classification.

= A

3	Which equation correctly shows S as the subject of $25P = 50\pi(R - \dfrac{S}{2})$

Solution

$$\frac{25P}{50\pi} = R - \frac{S}{2}$$

$$\frac{P}{2\pi} - R = -\frac{S}{2}$$

$$2R - \frac{2P}{2\pi} = S$$

$$2R - \frac{P}{\pi} = S$$

$$= C$$

4	The following boxplots show the distribution of the height of babies born in two different countries, country A and country B. Based on the boxplots shown, it can be said that **Solution** 50% of the babies born in country B are taller than all of the babies born in country A. <center>= A</center>
5	Claire measured her height as 1.65 m, correct to the nearest centimetre. What is the percentage error in her measurement? **Solution** $$\text{Absolute Error} = \pm 0.005$$ $$\text{Percentage Error} = \frac{0.005}{1.65} \times 100\%$$ $$= 0.3\%$$ $$= C$$
6	In a raffle, the total prize money is shared among the first three tickets drawn in the ratio 4 : 3 : 2. The prize for the second ticket drawn is $750. What is the total prize money? **Solution** $$1 \text{ part} = \$750 \div 3 \text{ parts}$$ $$= \$250$$ $$\text{Total Parts} = 4 + 3 + 2$$ $$= 9$$ $$\text{Total Prize Money} = 9 \times 250$$ $$= \$2250$$ $$= C$$

		7

7 A survey of 120 students was conducted. They were asked their gender and if they played a sport. The results are summarised in the table below.

	Male	Female	Total
Sport	50	30	80
No Sport	15	25	40
Total	65	55	120

A student is selected at random from the males. What is the probability that the student selected plays a sport?

Solution

$$P(\text{Male plays sport}) = \frac{50}{65}$$
$$= \frac{10}{13}$$
$$= C$$

8 A network contains 30 vertices. How many edges are required to form a spanning tree?

Solution
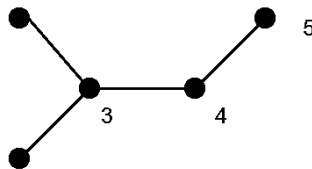
5 vertex networks have 4 edges.
Number of edges in a spanning tree is equal to the number of vertices-1. $E = V - 1$.
$$E = 30 - 1$$
$$= 29 \; edges$$
$$= C$$

| 9 | The diagram shows a triangle ABC where $AC = 44cm$, $AC = 27cm$, $\angle BCA = 32°$ and angle ABC is obtuse.
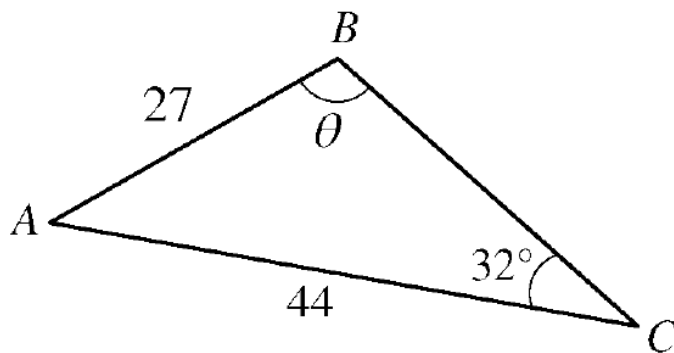
What is the size of the obtuse angle ABC to the nearest degree?

Solution

$$\frac{\sin x}{44} = \frac{\sin 32}{27}$$

$$\sin x = \frac{44 \times \sin 32}{27}$$

$$x = \sin^{-1}(\frac{44 \times \sin 32}{27})$$

$$x = 59°43'$$

$$\theta = 180 - 59°43'$$

$$\theta = 120°17'$$

$$= C$$ |
| 10 | The length of a string on a musical instrument varies inversely to its frequency vibration. A 32.5 cm string on a violin has a frequency vibration of 400 cycles per second. What would be the frequency vibration of a 25 cm string?

Solution

$$L = \frac{k}{f}$$

$$32.5 = \frac{k}{400}$$

$$k = 32.5 \times 400$$

$$k = 13000$$

$$L = \frac{13000}{f}$$

$$25 = \frac{13000}{f}$$

$$f = \frac{13000}{25}$$

$$f = 520$$

$$= C$$ |

11	Which of the following graphs represent the graph $y = 5(0.9)^x$

A.
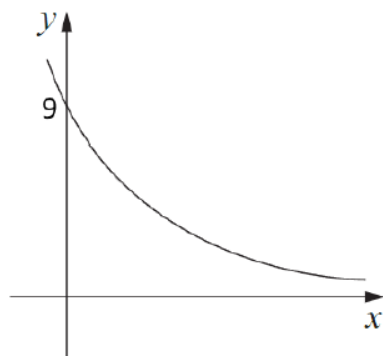
B.
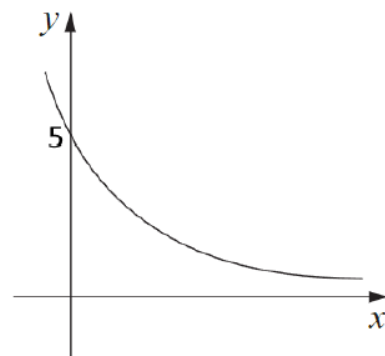
C.
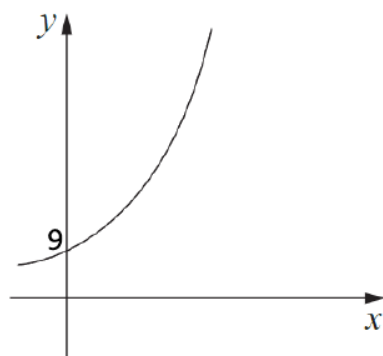
D.
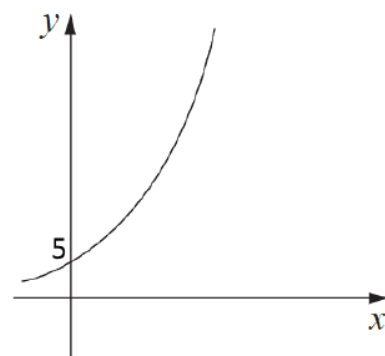
Solution

To find y-intercept let $x = 0$

$$y = 5(0.9)^0$$

$$y = 5 \times 1$$

$$y = 5$$

0.9 represents decay as it is less than 1. Graph needs to be decreasing.

= B

12	Linley flew from Sydney (UTC+ 10) to Rio de Janeiro (UTC- 3). Her plane left Sydney at 8:30 a.m. Thursday (Sydney time) and arrived in Rio de Janeiro at 2:00 p.m. Thursday (Rio de Janeiro time).

What was the total flying time?

Solution

$$\text{Time Difference} = 13 \text{ hours}$$
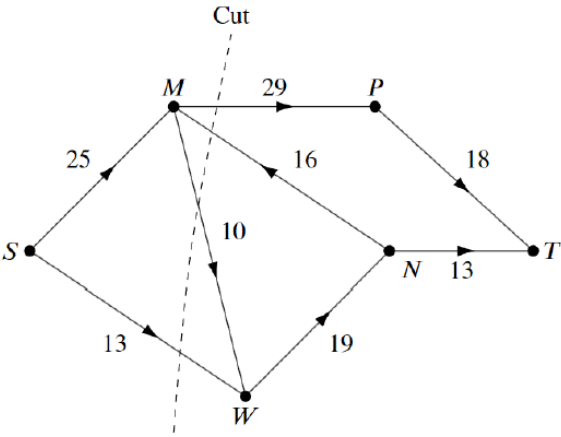
$$8.30\text{am} - 13 \text{ hours} = 7.30\text{pm Thurs}$$

$$\text{Flight time} = 2\text{pm Weds} - 7.30\text{pm Thurs}$$
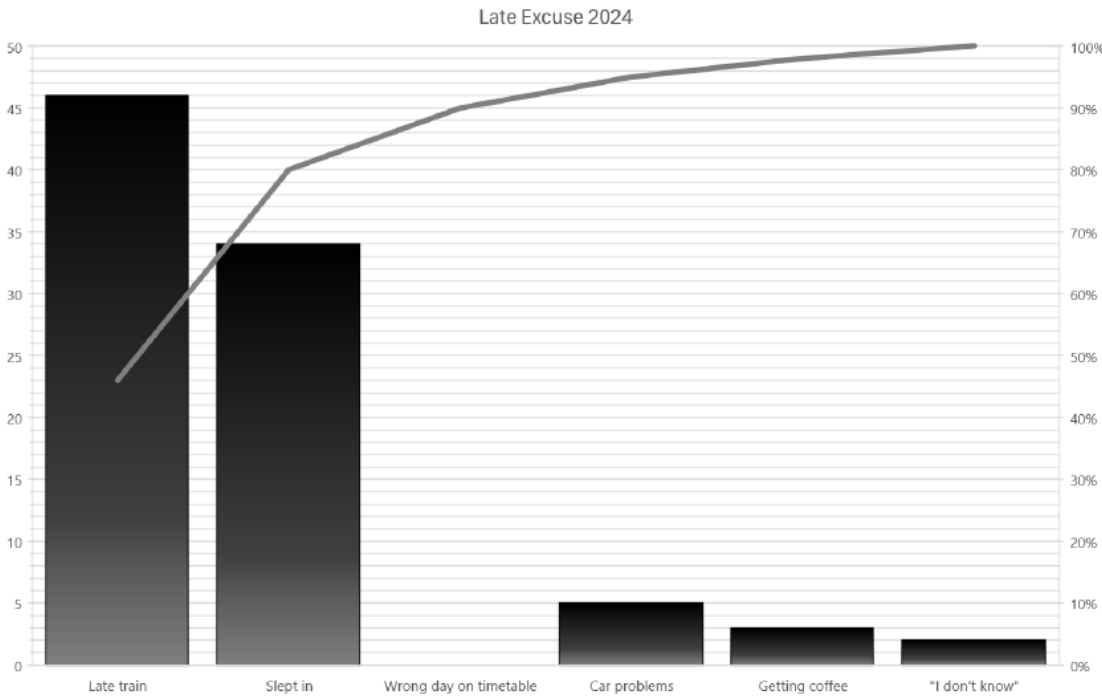
$$= 18.5 \text{ hours}$$

$$= D$$

13	There were total of 22 400 people who flew on the USS Enterprise D. The ratio of passengers to crew was 6 : 29. When the starship was crashing on Veridian III, all of the passengers were able to evacuate while 3 200 of the crew did not evacuate.

For those who evacuated, what is the ratio, in its simplest form, of passengers to crew?

Solution

$$6 : 29 \Rightarrow \text{Total parts} = 35$$

$$\text{Number of passengers} = \frac{6}{35} \times 22400 = 3840$$

$$\text{Number of crew} = \frac{29}{35} \times 22400 = 18560$$

$$\text{Crew who evacuated} = 18560 - 3200 = 15360$$

$$\therefore \text{ Ratio of passengers : crew (who evacuated)}$$

$$= 3840 : 15360$$

$$= 1 : 4$$

$$= A$$

14	The IQs of 80 Gosford High School teachers are normally distributed with a mean of 108 and a standard deviation of 6.3.

How many teachers are expected to have an IQ of more than 120.6?

Solution

$$z = \frac{120.6 - 108}{6.3}$$

$$z = 2$$

$$P(z > 2) = 2.5\%$$

$$2.5\% \times 80 = 2 \text{ teachers}$$

$$= A$$

15	What is the capacity of the cut shown in the directed graph below?

Solution

16 not included as it travels from sink to source
$$Cut = 29 + 10 + 13$$
$$= 52$$
$$= C$$

16a	Sol purchased a new car for $52 000. It depreciated initially by using straight-line depreciation for the first 4 years at a rate of $2 000 per year.

(a) Calculate the value of the car at the end of the fourth year.   **1**

Solution
$$Salvage = \$52000 - 4 \times \$2000$$
$$= \$44000$$

Marking Criteria
(1) Correct value after fourth year

Markers Comment
Well done.

16b	After the fourth year, Sol changed the method of depreciation to the declining balance method at the rate of 18% per annum. **2**

Calculate the value of the car ten years after it was purchased

Solution
$$Salvage = 44000(1 - 0.18)^6$$
$$= \$13376.29$$

Marking Criteria
(1) Correct number of periods
(1) Correct value after 10 years

Markers Comment
Number of people didn't read the question and determine that the number of periods was 6 years, not 10.

16c	Without further calculations, complete the graph below to show the value of the car over 10 years	2

Solution

Marking Criteria

(1) Provides correct linear relationship

(1) Provides correct declining balance relationship

Markers Comment

A number of students were not aware that the declining-balance method of depreciation when graphed isn't linear. Some students curved the graph in the wrong direction, it is concave up.

17a	Mr Eveleigh collated information about reasons that his students were late to his class over a period of 1 term. The data is displayed in a Pareto chart below. The column showing the number of students late due to looking at the wrong day on their timetable has been removed from the chart. **(a)** How many students claimed they were late due to getting coffee?	**1**
	Solution Reading off the left y-axis on the graph. Getting coffee = 3 students.	
	Marking Criteria (1) Provides correct answer	
	Markers Comment Well done.	
17b	What percentage of students were late due to a late train or sleeping in?	**1**
	Solution Reading off the right y-axis on the graph. Cumulative freq. for slept in (which includes late train) = 80%	
	Marking Criteria (1) provides correct answer	
	Markers Comment Well done.	

17C	How many students were late due to looking at the wrong day on their timetable?	2

Solution

Reading off the right y-axis on the graph.
Cumulative freq. for wrong day on their timetable – cumulative freq. for slept in.
$$= 90\% - 80\%$$
$$= 10\%$$
$$80\% = 80 \; students$$
$$\therefore 10\% = 10 \; students$$

Marking Criteria
(1) Finds 10%
(1) Finds 10 students

Markers Comment
A number of students correctly identified it as 10% but were unable to determine the total number of students being 100.

18a	Joel sits a Mathematics test and Business Studies test.	

(a) Joel's mark in the Mathematics test is 76. The mean mark for this test is 82 and the standard deviation is 6.   **2**

Joel's z-score is the same in both the Mathematics tests and the Business Studies test.

In the business studies test, Joel's mark was 81 and the standard deviation is 3.

What is the mean in the Business Studies test?

Solution

$$z = \frac{76 - 82}{6}$$
$$z = -1$$
$$-1 = \frac{81 - \overline{x}}{3}$$
$$-3 = 81 - \overline{x}$$
$$\overline{x} = 81 + 3$$
$$\overline{x} = 84$$

Marking Criteria
(1) Finds correct z-score
(1) Finds correct mean

Markers Comment
Well done.

| 18b | King Business, Joel's Business Studies teacher, realised he left out Jinhyun's marks for his calculations. He calculates the new mean to be 85. There are 15 students in the class in total. | 2 |

What is Jinhyun's mark on the test?

Solution

$$\text{Let } x \text{ be Jinhyun's mark}$$

$$85 = \frac{14 \times 84 + x}{15}$$

$$85 = \frac{1176 + x}{15}$$

$$1275 = 1176 + x$$

$$x = 1275 - 1176$$

$$x = 99$$

Marking Criteria
(1) Find total marks scored
(1) Find correct score

Markers Comment
Recommend students revise how to calculate the new mean from a previous mean.

| 19a | Yunbin owns a share portfolio. Details of her share portfolio at 30 June 2024 are given in the table. |

Company Name	Number of shares in Yunbin's portfolio	Dividend yield (per annum)	Market price per share
ACE	350	4.5%	$6.32
ZAP	50	?	$24.80

Yunbin received a total annual dividend of $188.82 from her share portfolio.

(a) Calculate the total dividend that Yunbin received from ACE on 30 June 2024.   1

Solution

$$\text{ACE dividend} = 350 \times 6.32 \times 4.5\%$$

$$= \$99.54$$

Marking Criteria
(1) Finds correct answer

Markers Comment
Well done.

19b		Calculate the dividend yield of company ZAP on 30 June 2024.	2
	Solution		
		$$\text{ZAP dividend} = 188.82 - 99.54$$ $$= 89.28$$ $$\text{ZAP div. yield} = \frac{89.28}{24.80 \times 50}$$ $$= 0.072$$ $$= 7.2\%$$	
	Marking Criteria (1) Finds correct dividend (1) Finds correct dividend yield		
	Markers Comment Generally well done.		
20		A compass radial survey of the field ABC has been conducted from O. Find the area of the section AOC to the nearest square metre.	2
	Solution		
		$$\angle COB = 57 + (360 - 321)$$ $$= 96°$$ $$Area AOC = \frac{1}{2} \times 54 \times 72 \times \sin(96)$$ $$= 1933.35$$ $$= 1933 \ m^2$$	
	Marking Criteria (1) Finds correct angle (1) Finds correct area		
	Markers Comment Some students were unable to determine the angle using the radial survey measurements. Some students used $\frac{1}{2} \times base \times height$.		

21	A bag contains 8 green balls and 6 white balls. Two balls are selected at random without replacement. **4**

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.

Solution

First draw   Second draw

White $\dfrac{5}{13}$ — White

$\dfrac{6}{14}$ — White

$\dfrac{8}{13}$ — Green

$\dfrac{8}{14}$ — Green

$\dfrac{6}{13}$ — White

$\dfrac{7}{13}$ — Green
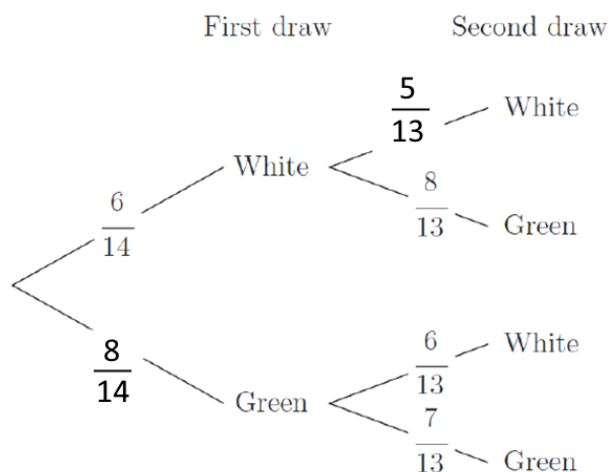
$$P(WW) = \frac{6}{14} \times \frac{5}{13} = \frac{30}{182}$$

$$P(GG) = \frac{8}{14} \times \frac{7}{13} = \frac{56}{182}$$

$$P(Same) = P(WW) + P(GG)$$

$$= \frac{30}{182} + \frac{56}{182}$$

$$= \frac{43}{91}$$

Marking Criteria
(1) Completing probability tree correctly
(1) Finding P(WW) correctly
(1) Finding P(GG) correctly
(1) Adding outcomes to find P(Same)

Markers Comment
Well done. Some students didn't find the probably of both whites and both greens together.
Students need to give exact answer, i.e. leave it as a fraction.

22a	The following scatterplot shows the average attendance figures at home games, plotted against the number of games won in the 2023 NRL season, where teams played 24 games. The line of best fit is also shown.	
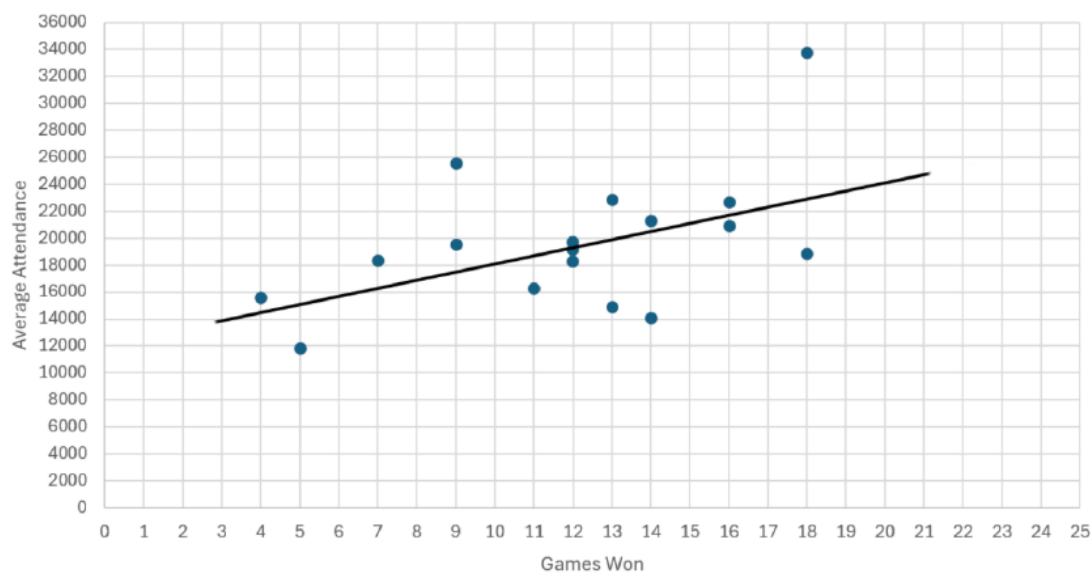
(a) Determine the equation of the line of best fit using the coordinates at 10 games won and 20 games won.   **2**

Solution

$$gradient = \frac{6000}{10}$$
$$= 600$$
$$y-\text{int} = 18000 - 10 \times 600$$
$$= 12000$$
$$\therefore y = 600x + 12000$$

Marking Criteria
(1) Gradient
(1) Y-intercept

Markers Comment
Many students only calculated the gradient and did not state the equation of the line which requires the y-intercept.

22b   Interpret the slope of the line of best fit.   **1**

Solution
For every game won in a season, 600 more fans attend games.

Marking Criteria
(1) correct answer

Markers Comment
Most students need to review the significance of the slope of the line.

22c	A new team, the Perth Bears, is expected to have an average attendance of 27000. Using the graph, or otherwise, estimate the number of games they are expected to win.	1

Solution

$$27000 = 600x + 12000$$
$$15000 = 600x$$
$$x = \frac{15000}{600}$$
$$x = 25$$

Marking Criteria
(1) correct answer

Markers Comment
Well done.

22d	Explain why the extrapolation of the Perth Bears average attendance is unreliable.	1

Solution
We are extrapolating outside of our data range, which can return inaccurate results. Perth Bears are predicted to win 25 games form our extrapolation, when there are only 24 games in a season.

Marking Criteria
(1) correct answer

Markers Comment
Students were unable to connect part (d) to the original question.

23	Ebony invested \$15 500 in an account that earned \$2 255 interest after 6 years. The interest was compounded monthly.	4
	Find the annual interest rate as a percentage, correct to 1 decimal place.	
	Solution	

$$FV = 15500 + 2255$$
$$= 17755$$
$$17755 = 15500(1+r)^{6 \times 12}$$
$$\frac{17755}{15500} = (1+r)^{72}$$
$$\sqrt[72]{1.145...} = 1+r$$
$$1.001888... = 1+r$$
$$r = 1.001888... - 1$$
$$r = 0.001888... \text{ per month}$$
$$r = 0.001888... \times 12$$
$$r = 0.22659...$$
$$r = 2.3\% \text{ p.a.}$$

Marking Criteria
(1) Correct future value
(1) Using compound interest formula
(1) Using compound interest formula correctly
(1) Finding the correct value of r

Markers Comment
Common mistakes arose throughout. Including not changing period to monthly, not recognising that the FV is the PV+I, and some students struggle with the algebraic skills required in the question.

24	The following formula can be used to calculate an estimate for blood alcohol content (BAC) for males.	4

$$BAC_{male} = \frac{10N - 7.5H}{6.8M}$$

N is the number of standard drinks consumed

M is the person's weight in kilograms

H is the number of hours drinking

Mr Kellerman weighs 79 kg. His BAC was zero when he began drinking alcohol. At 11:00 pm, after consuming 2 bottles of wine, his BAC was 0.07. Each bottle of wine has 6.3 standard drinks.

Using the formula, estimate at what time Mr Kellerman began drinking alcohol, to the nearest minute.

Solution

$$0.07 = \frac{10 \times (6.3 \times 2) - 7.5 \times H}{6.8 \times 79}$$

$$0.07 = \frac{126 - 7.5H}{537.2}$$

$$0.07 \times 537.2 = 126 - 7.5H$$

$$37.604 - 126 = -7.5H$$

$$H = \frac{-88.396}{-7.5}$$

$$H = 11.786$$

$$H = 11 \text{ hours } 47 \text{ min}$$

$$\Rightarrow 11\text{pm} - 11 \text{ hrs } 47 \text{ min} = 11:13\text{am}$$
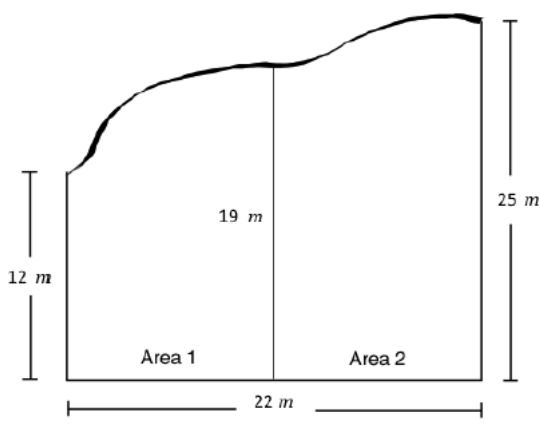
$$\therefore \text{Mr Kellerman began drinking at } 11:13\text{am}$$

Marking Criteria
(1) Substituting correctly
(1) Finding correct value of H
(1) Converting H to hours and minutes
(1) Finding correct time

Markers Comment
Well done. Students who got it wrong were let down by their algebra skills.

25a	A surveyor provided the following diagram with measurements for the roof of a property in Gosford that she was mapping out.

(a) Find the approximate total area of the roof of the property by using two applications of the trapezoidal rule. **2**

Solution

$$A = \frac{11}{2}(12+19) + \frac{11}{2}(19+25)$$

$$= 412.5 \text{ m}^2$$

Marking Criteria
(1) Using the correct trapezoidal formula
(1) Finding correct area

Markers Comment
Many students who got this wrong used 22 as the height of each trapezium.

25b	The surveyor is reading a meteorological report that lists the average monthly rainfall in the Gosford region. According to the report, April sees 75 mm of rainfall on average. **2** What volume of rainfall can the surveyor expect to fall over the property next April?

Solution

$$V = 412.5 \text{ m}^2 \times 0.075 \text{ m}$$

$$= 30.9375$$

$$\approx 31 \text{ m}^3$$

Marking Criteria
(1) For using correct formula
(1) For correct volume

Markers Comment
Some students were unable to correctly convert from mm to m.

25c	The rainfall that hits the roof of the property is then collected in a cylindrical tank with a diameter of 360 cm.	2

Assuming the tank was empty before the rainfall and that all of the rainfall is directed into the tank, what is the height of the water in the tank after the rainfall? Answer correct to the nearest centimetre.

Solution

$$31 = \pi \times 1.8^2 \times h$$

$$h = \frac{31}{\pi \times 1.8^2}$$

$$h = 3.0455...$$

$$h = 305 \text{ cm}$$

Marking Criteria
(1) For using correct formula
(1) Finding h

Markers Comment
Very poorly done. Many students did not use the correct formula. It is important to know which formula is which on the formula sheet.

26a

Khoi's Kite Kiosk sells kites as a part of his business. He can make a maximum of 30 kites per week. The fixed weekly cost of productions is a and the variable cost of production is b per kite.

The diagram below shows a graph of Khoi's weekly production costs. The equation of this graph is given by $C = bx + a$.

Planned income and costs for Khoi's business

(a) Determine the values of a and b **2**

Solution

$$a = y - \text{int}$$
$$a = 50$$
$$b = gradient$$
$$b = \frac{50}{10}$$
$$b = 5$$
$$\therefore C = 5x + 50$$

Marking Criteria
(1) for correct gradient
(1) for correct y intercept

Markers Comment
Generally well done.

| 26b | Khoi sells his kites for $9 each. Write an equation representing the income I made from selling n kites. | 1 |

Solution

$$I = 9n$$

Marking Criteria
(1) Finding correct equation

Markers Comment

26c	On the diagram above, draw the straight line representing the income equation in (b)	1

Solution

Planned income and costs for Khoi's business

Marking Criteria
(1) For correct graph

Markers Comment
Graphing of the equation was "pretty good".

26d	Use the graph to solve the two equations simultaneously for x and explain the significance of this solution for Khoi's business.	2

Solution

$$x = 12.5 \text{ kites}$$

This is Khoi's breakeven point. His costs equal his income, so he is making neither a profit nor loss. If Khoi sells >12.5 kites he will make a profit.

Marking Criteria
(1) for demonstrating finding break even point
(1) For correct answer from graph as stated in question

Markers Comment

| 26e | Calculate the how many kites would need to be sold to make a profit of $50 | 1 |

Solution

$$I - C = 50$$
$$9x - (5x + 50) = 50$$
$$9x - 5x - 50 = 50$$
$$4x = 50 + 50$$
$$x = \frac{100}{4}$$
$$x = 25$$

Alternatively:

Planned income and costs for Khoi's business

Marking Criteria
(1) correct solution

Markers Comment
Generally well done.

| 27 | Two observers at A and B on horizontal ground are 300 m apart. From A, the angle of elevation of the top C of a tall building DC is 32°.

It is also known that ∠DAB = 59° and ∠ADB = 78°.

Find the height of the building, correct to the nearest metre. | 4 |
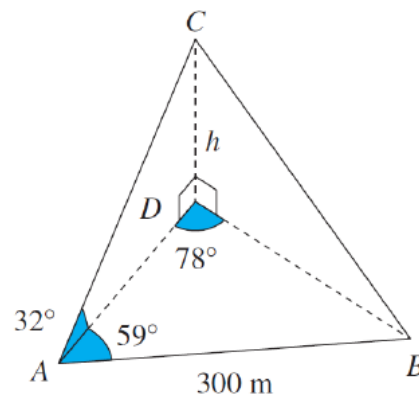
Solution

$$\angle DBA = 180 - 59 - 78 \ (\angle \text{ sum of triangle})$$

$$\angle DBA = 43$$

$$\frac{AD}{\sin 43} = \frac{300}{\sin 78}$$

$$AD = \frac{300\sin 43}{\sin 78}$$

$$AD = 209.17...$$

$$\tan 32 = \frac{h}{209.17...}$$

$$h = 209.17... \times \tan 32$$

$$h = 130.704$$

$$h = 131 \text{ m}$$

Marking Criteria
(1) Finding ∠DBA
(1) Using Sine rule
(1) Using Sine rule correctly
(1) Finding *h* correctly rounding off

Markers Comment
Generally well done. This was also the units question.

28a	Jessie borrowed $439 000 to buy a house. The loan is to be repaid over 25 years at a rate of 6.2% per annum, compounded monthly. The repayments have been set at $2 882 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	$439 000	$2 268.17	$2 882	$438 386.17
2	$438 386.17	A	$2 882	$437 769.17
3	$437 769.17	$2 261.81	$2 882	$437 148.98
4	$437 148.98	$2 258.60	$2 882	B

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

Solution

$$A = \frac{6.2}{12}\% \times 438386.17$$
$$= \$2265$$

Alternatively:
$$437769.17 = 438386.17 + A - 2882$$
$$A = 437769.17 - 438386.17 + 2882$$
$$A = 2265$$
$$B = 437148.98 + 2258.60 - 2882$$
$$B = 436525.58$$

Marking Criteria
(1) Finding *A*
(1) Finding *B*

Markers Comment
Generally well done.

28b	What is the total to be repaid over the 25 years? **1**

Solution
$$Total = 25 \times 12 \times 2882$$
$$= \$864600$$

Marking Criteria
(1) For correct answer

Markers Comment
Some students did not recognise the simplicity of the question.

28c	After 10 years of repaying the loan, Jessie decides to make a lump sum payment of $100 000 and to continue making monthly repayments of $2 882. The loan will then fully be repaid after a further 128 monthly repayments. Using your answer from part (b), calculate how much less Jessie will pay overall by making the lump sum payment.	2

Solution

$$Total = 100000 + (120 + 128) \times 2882$$
$$= \$814736$$
$$Savings = 864600 - 814736$$
$$= \$49864$$

Marking Criteria
(1) Finds correct total
(1) Finds correct savings

Markers Comment
Students didn't interpret part (c) and link it to the previous parts of the question.

29 A random variable is normally distributed with a mean of 0 and a standard deviation of 1. The table gives the probability that this random variable lies below z for some positive values of z. **3**

z	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39
Probability	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177

The probability values given in the table are represented by the shaded area in the following diagram.

The HSC results for Mathematics Standard students at Gosford High School form a normal distribution with mean $\mu = 87.2$, and standard deviation $\sigma = 8.905$.

In a group of 40 students, how many would be expected to score more than 75?

Solution

$$z = \frac{75 - 87.2}{8.905}$$

$$z = -1.37$$

$$P(z > -1.37) = P(z < 1.37)$$

$$= 0.9147$$

$$\Rightarrow 40 \times 0.9147 = 36.588 \text{ students}$$

$$\therefore 36 \text{ (or 37) students expected to score more than 75}$$

Marking Criteria
(1) Finds correct z score
(1) Uses table correctly
(1) Recognises P(z > -1.37) = P(z < 1.37)
(1) Finds correct answer

Markers Comment
Generally well done.

| 30a | Hannah's Hat Haberdashery makes and sells hats. She can make and sell 80 hats per week. Each hat currently costs $10.

Hannah is currently selling out of all of her hats every week. She decides to increase the price of the hats to see if she can increase the income earned each week.

It is assumed that for each one dollar increase in hat price, there will be 2 fewer hats sold.

If Hannah charges $(10 + x)$ dollars for each hat, a quadratic model for the income raised, I, from selling hats is $I = -2x^2 + 60x + 800$.

A graph showing this relationship between increase in hat price and the revenue is shown below. The x-intercepts have been labelled.

(a) By first finding a suitable value of x, find the price Hannah should charge for each hat to maximise the income raised from the sales of the hats. **2** |

Solution

Solution 1 (from turning point of graph):

Quadratic maximum happens halfway between x-intercepts.

$$x_{max} = \frac{40 + (-20)}{2}$$

$$x_{max} = 10$$

∴ Hannah should sell hats for $10 + 10 = \$20$ to maximise I

Solution 2 (from guess and check):

$$let\ x = 15$$
$$I = -2(15) + 60(15) + 800$$
$$I = 1250$$

Greater than all other substitutions

Marking Criteria
(1) Finding the maximum x value
(1) Calculating the maximisation price for the hats

Markers Comment
Due to a small error when making the question there were 2 possible answers that were accepted for this question and the subsequent questions. The -20 x-intercept should have been a -10 x-intercept. If you used the intercepts as given you would have got the answer above but by using the guess and check method, you would have found that 15 was the maximum x value. Many students found the maximum x value but didn't state the price that the hats should be. Reread the questions to make sure you have answered them.

| 30b | What is the number of hats sold when the income is maximised? | 1 |

Solution

Each dollar increase sells 2 fewer hats.
$10 increase means $10 \times 2 = 20$ fewer hats.
$\therefore$ Hannah sells 60 hats

Marking Criteria
(1) Calculating the number of hats sold

Markers Comment
Many students left this question blank even after answering the previous part. The information to do this was given on the 3rd line of the question. Another solution that some students used was to find the total income for that price and divide it by the price of the hats, thus giving the number of hats.

| 30c | The cost to Hannah of making each hat is $500 plus $5 per hat. Calculate the profit earned by Hannah when the income earned from each hat is maximised. | 2 |

Solution

$$\text{Cost} = 500 + 5 \times 60$$
$$= 800$$
$$\text{Income} = -2(10)^2 + 60(10) + 800$$
$$= 1200$$
$$\text{Profit} = \text{Income - Cost}$$
$$= 1200 - 800$$
$$= \$400$$

Marking Criteria
(1) Calculating the cost
(1) Calculating the profit

Markers Comment
If you were able to calculate the number of hats from the previous you could calculate the cost. Many students struggled to find the income using the original equation.

| 30d | Find the value of the intercept of the parabola with the vertical axis. | 1 |

Solution

y-int exists when $x = 0$
$let\ x = 0$
$$I = -2(0)^2 + 60(0) + 800$$
$$I = \$800$$

Marking Criteria
(1) Finding the y-intercept

Markers Comment
Students who didn't do the previous parts should still been able to answer this question. Around 50% of students answered this well. To find the y-intercept, you let the x-value = 0. A very commonly tested technique in the HSC.

31	The capture-recapture technique was used to estimate a population of duckbill platypus.	3

The capture-recapture technique was used to estimate a population of duckbill platypus.

In 2020, 36 platypuses were caught, tagged and released.

2 years later, in 2022, some platypuses were captured in the same area. Eight of these were found to be tagged, which was 40% of the total captured during 2022.

Calculate the estimate for the total population of platypus in this area.

Solution

$$\text{let } x = \text{Total captured 2022}$$
$$\frac{8}{40} = \frac{x}{100}$$
$$x = \frac{8 \times 100}{40}$$
$$x = 20$$
$$\text{Let } y = \text{total population}$$
$$\frac{36}{y} = \frac{8}{20}$$
$$y = \frac{36 \times 20}{8}$$
$$y = 90$$
$$\therefore \text{Total population of platypuses is } 90$$

Marking Criteria
(1) Finding the total captured in 2022
(1) Establishing the capture-recapture ratio
(1) Finding the total population of platypuses

Markers Comment
Most students were able to find the total captured in 2022 and go on and apply ratios to find the total population. Some students who didn't find the total captured in 2022 were able to get carried from previous error marks by still establishing the ratio and rearranging.

| 32 | The table shows the income tax rates for the 2023-2024 financial year. | 3 |

Taxable Income	Tax on this income
0 - $18 200	Nil
$18 201 - $45 000	19c for each $1 over $18 200
$45 001 - $120 000	$5 092 plus 32.5c for each $1 over $45 000
$120 001 - $180 000	$29 467 plus 37c for each $1 over $120 000
$180 001 and over	$51 667 plus 45c for each $1 over $180 000

The Medicare levy is calculated as 2% of taxable income.

For the 2022-2023 financial year, Lachlan pays a Medicare levy of $3 193.10.

Calculate the tax payable on Lachlan's taxable income.

Solution

$$\frac{3193.10}{2\%} = \frac{\text{taxable income}}{100\%}$$

$$\text{taxable income} = \$159655$$

$$\text{tax payable} = 29467 + 0.37(159655 - 120000)$$
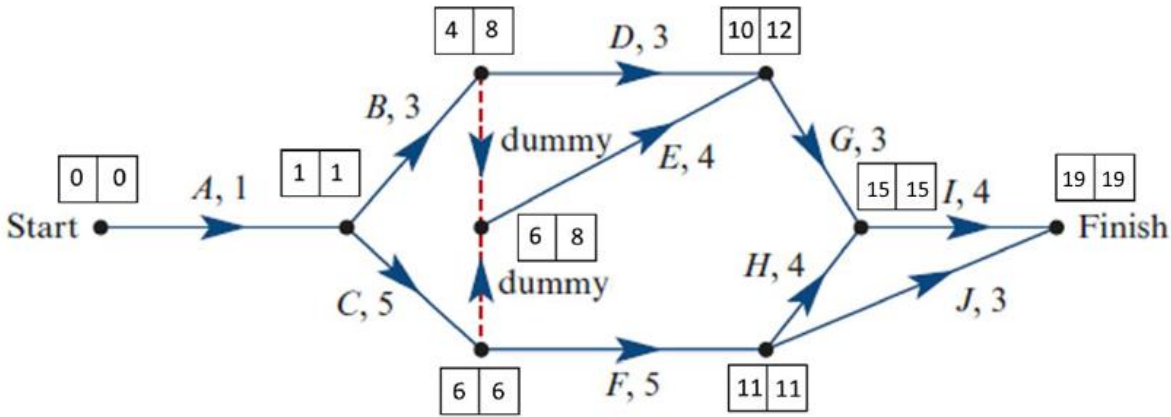
$$= \$44139.35$$

Marking Criteria
(1) Calculating the taxable income
(1) Selecting the correct tax bracket
(1) Calculating the tax payable

Markers Comment

This question was mostly done well by all. Some students subtracted the Medicare levy from the taxable income before calculating the tax payable which cost them a mark. Students weren't deducted a mark for also included the Medicare levy in the tax payable.

33a	Consider the activity network below. Forward and backwards scanning has been partially completed. **(a)** By completing the scanning on the network above, state the minimum completion time for the project **1**	
	Solution Minimum completion time = 19 weeks	
	Marking Criteria (1) Forward scanning to find the minimum completion time.	
	Markers Comment 25% of students were unable to forward scan to get the minimum completion time. This is a core skill in the HSC.	
33b	State the critical path **1**	
	Solution A-C-F-H-I	
	Marking Criteria (1) Finding the critical path	
	Markers Comment Students who listed the float time for each activity were easily able to go on and identify the critical path.	

| 33c | By employing more workers, it is possible to reduce the time of some activities. However, this will incur extra costs. The activities which can be reduced in time, the associated costs and maximum reduction in time are shown in the table below. | **2** |

Activity	Cost (dollars per week)	Maximum reduction (weeks)
E	1000	2
F	1500	3
H	2000	3
J	200	2

What is the new minimum completion time now possible for the project?

Solution

Don't reduce J, not on critical path or secondary critical path.
Reduce F by 3. New critical path becomes A-C-dummy-E-G-I.
Reduce E by 2. A-C-F-H-I becomes critical path again.
Reduce H by 1. Both A-C-F-H-I and A-C-dummy-E-G-I are both critical paths.
Minimum completion time = 15 weeks

Marking Criteria
(1) Reducing only activities that were on critical paths
(1) Calculating the new minimum completion time of 15 weeks

Markers Comment
Students made it very difficult to award marks for this question. It is understandable that there is some guess and checking on this question using the network diagram. However, when you decide what to reduce you should list out the process on the lines given on the question. 6 lines were given for working out, this should have been a clue that more was needed for an answer than minimum completion time =.
This was probably the hardest question on the exam and one of the worst answered.

| 33d | What is the minimum cost of completing the project in this time? | **1** |

Solution

$$Cost = 1500 \times 3 + 2000 \times 1 + 1000 \times 2$$
$$= \$8500$$

Marking Criteria
(1) Calculating the minimum cost of completing in 15 weeks

Markers Comment
By not communicated clearly what you reduced on the previous question, it was difficult to give carried from previous error marks for this question.
Some students misinterpreted the cost for reducing, instead thinking it was X amount of dollars for the final minimum completion time.

34a	Shanon is a truck driver who frequently travels between Melbourne and Sydney. She has drawn a network diagram, as shown below, with all of the major towns as vertices and the major roads between those towns as edges. The weights on the edges represent the distance along the roads between the towns, in kilometres.
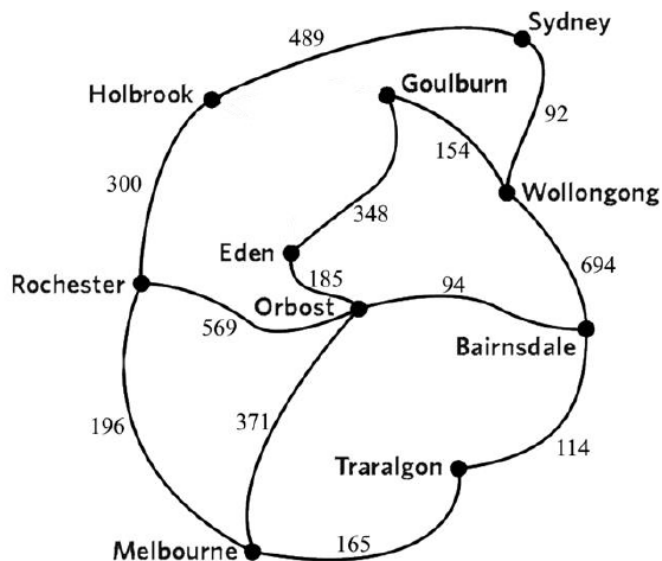
(a) Shanon wants to travel from Melbourne to Sydney in the shortest distance possible to save on fuel costs.   **2**

Describe the possible path she can take and the total distance she must travel.

Solution

$$\text{Shortest path} = Melb - Rochester - Holbrook - Sydney$$
$$= 196 + 300 + 489$$
$$= 985 \ km$$

Marking Criteria
(1) Identifying the shortest path
(1) Calculating the length of the shortest path

Markers Comment
Vast majority of students were able to identify the shortest path. Some students forgot to calculate the length of the path.

| 34b | Shanon's truck uses fuel at the rate of rate of 8.8 L/100 km on average for this trip. The cost of fuel is $1.87/L.

How much does the shortest path cost her in fuel? | 2 |

Solution

$$\frac{8.8\,\text{L}}{100km} = \frac{x}{985km}$$

$$x = \frac{985 \times 8.8}{100}$$

$$x = 86.68L$$

$$\text{Cost} = 86.68 \times 1.87$$

$$= \$162.09$$

Marking Criteria
(1) Calculate the amount of fuel per trip
(1) Calculate the cost for the fuel per trip

Markers Comment
Another well answer question.

34c	Shanon wants to upgrade to an electric truck to take advantage of the solar panel's that she has on her home. **4** Shanon's current daily electricity usage is 18.5 kWh. Charging the truck would take an extra 22.6 kWh. She has a solar panel system which generates 55 kWh of energy per day, exporting any unused energy to the grid. Shanon's energy retailer charges $0.235 per kWh and pays $0.10 per kWh for energy exported to the grid. What is Shanon's total daily financial benefit of having the solar panel system, correct to the nearest cent?

Solution

$$\text{Cost without solar} = \text{Fuel} + \text{Daily Usage}$$
$$= 162.09 + 18.5 \times 0.235$$
$$= \$166.44$$
$$\text{Revenue from solar} = \text{Unused Exported}$$
$$= (55 - 18.5 - 22.6) \times 0.10$$
$$= \$1.39$$
$$\text{Financial benefit} = 166.44 + 1.39$$
$$= \$167.83$$

Marking Criteria
(1) Including the lack of fuel as a financial benefit
(1) Calculating the cost of the daily usage without solar
(1) Calculating the revenue from exporting solar
(1) Calculating the total financial benefit

Markers Comment
Majority of students didn't include the lack of fuel as a financial benefit. Most were able to calculate the exported revenue. Some subtracted the daily usage cost from the financial benefit, this is a misunderstanding of how solar works, by having solar you no longer have to pull energy from the grid which costs money which makes it a benefit.
Key outcome of the year 12 course: develop the ability to use mathematical skills and techniques, aided by appropriate technology, to organise information and interpret practical situations.