2023

Hurlstone Agricultural High School
Year 12
Trial HSC Examination
HSC Assessment Task 4

Mathematics Standard 2

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

Total marks: 100

Section I – 15 marks (pages 2–9)
- Attempt Questions 1 – 15.
- Allow about 25 minutes for this section.

Section II – 85 marks (pages 11–32)
- Attempt Questions 16 – 36.
- Allow about 2 hours and 5 minutes for this section.

Section I

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

---

1   The stem-and-leaf plot below shows the ages of customers in a bookstore.

Stem	Leaf
0	4 5 5
1	2 2 3 8 8
2	3 6 8
3	2 3 4 4 7
4	0 1 6
5	7 9 9

What is the median age of customers in the bookstore?

A.   26

B.   28

C.   30

D.   32

2   Kyle measured the length of a pencil to be 18.24 cm.

What is the percentage error in Kyle's measurement?

A.   0.027%

B.   0.055%

C.   2.7%

D.   5.5%

3   Which diagram below best represents a relationship with a correlation coefficient of
$r = -0.87$?

A.

B.

C.

D.
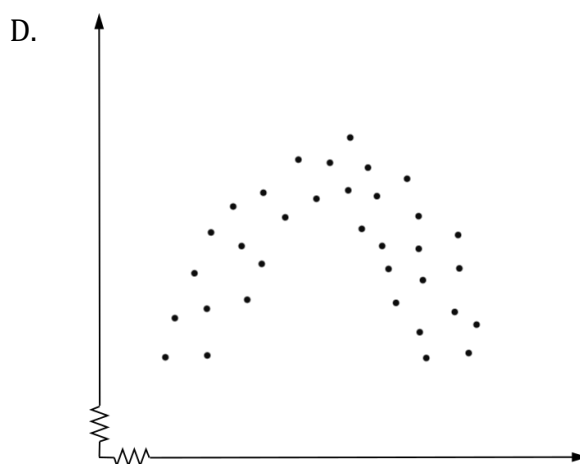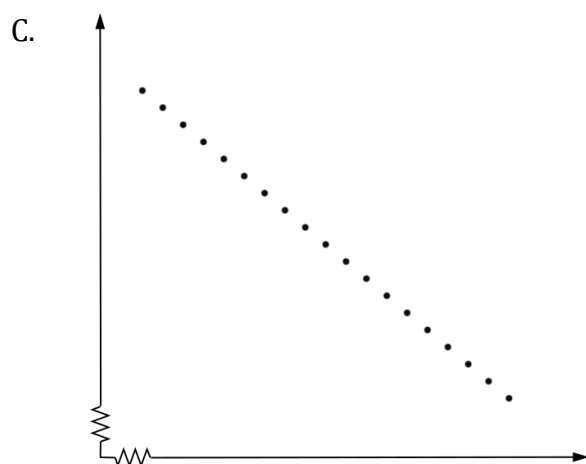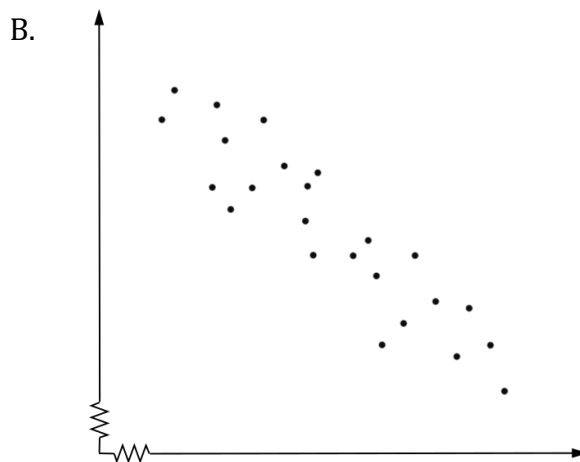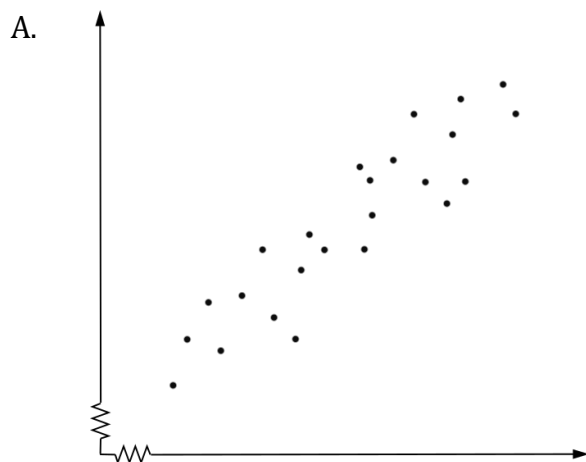
4   A car travels 420 km on 40 L of fuel.

What is the fuel consumption of the car?

A.   13.3 L/100 km

B.   10.5 L/100 km

C.   9.5 L/100 km

D.   8.3 L/100 km

5   Morgan lives in Santiago (UTC -5 hours) and her friend Tracey lives in Hanoi (UTC $+7$ hours).
At 6:00pm every Tuesday, Santiago time, Morgan calls Tracey.

What is the time and day in Hanoi when Tracey answers the phone?

    A.   6:00 am on Tuesday

    B.   6:00 am on Wednesday

    C.   6:00 pm on Tuesday

    D.   6:00 pm on Wednesday

6   A directed network diagram is shown below.
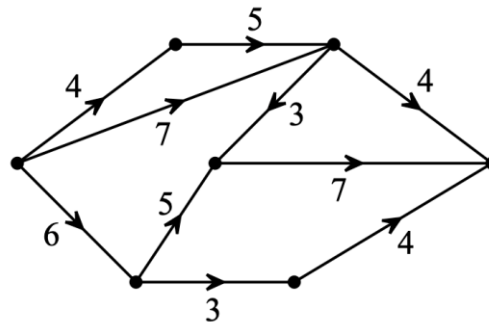
What is the maximum flow through this network?

    A.   11

    B.   12

    C.   13

    D.   14

7
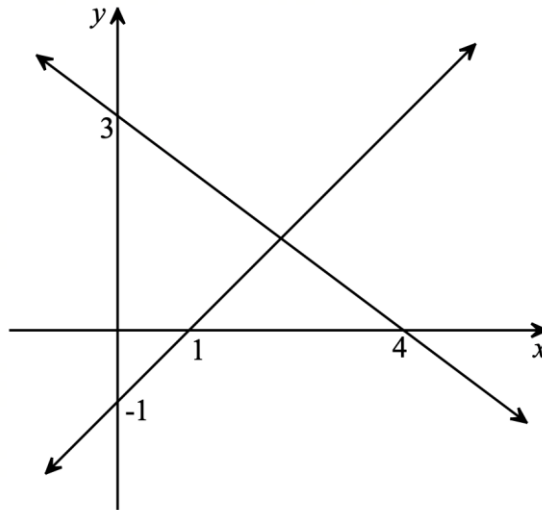
Which of the following pairs of simultaneous equations can be solved using the diagram above?

A. $y = \frac{3}{4}x + 3$ and $y = x - 1$

B. $y = -\frac{3}{4}x + 3$ and $y = x - 1$

C. $y = \frac{3}{4}x + 3$ and $y = x + 1$

D. $y = -\frac{3}{4}x + 3$ and $y = x + 1$

8   The time taken to build a tower varies directly with the height of the tower.

It takes 120 days to build a tower that is 45 metres tall.

How long would it take to build a tower that is 63 metres tall?

A.   24 days
B.   85 days
C.   138 days
D.   168 days

9   Karen purchases a car for $80 000. She sells the car five years later for half its purchase price.

What is the average annual depreciation of the car?

A.   8%

B.   10%

C. $8000

D. $10 000

10   A taxi driver charges his passengers a flat fee of $3 to begin a journey and then $1.75 per kilometre travelled.

It costs him $0.25 in fuel per kilometre travelled.

Which equation below best represents the profit, P, generated by driving n kilometres per trip?

A. $P = 3n - 1.5$

B. $P = 1.5n - 3$

C. $P = 3 - 1.5n$

D. $P = 3 + 1.5n$

11   The area, A, of an annulus is given by the formula $A = \pi R^2 - \pi r^2$ where r is a positive number.

Which of the following is correct rearrangement of the formula?

A. $r = \sqrt{\dfrac{\pi R^2 - A}{\pi}}$

B. $r = \sqrt{\dfrac{A - \pi R^2}{\pi}}$

C. $r = A - \dfrac{R^2}{\pi}$

D. $r = \pi - \dfrac{R^2}{A}$

12   Ben makes regular contributions each month into an annuity with an interest rate of 6% per annum, compounding monthly.

The table below shows the future value of an annuity of $1 for various interest rates (r) and numbers of periods (n).

Table of present value interest factors

n \ r	Interest rate per period				
	0.5%	1%	2%	4%	8%
2	2.005	2.010	2.020	2.040	2.080
4	4.030	4.060	4.122	4.246	4.506
6	6.076	6.152	6.308	6.633	7.336
8	8.141	8.286	8.583	9.214	10.637
12	12.336	12.683	13.412	15.026	18.977

Ben wishes to save for a $5000 holiday in one year's time. How much will Ben need to contribute each month to save up for the holiday?

A. $61 680

B. $31 540

C. $792.64

D. $405.32

13 A group containing people under 40 years of age and over 40 years of age were surveyed about whether they preferred cats or dogs as pets. The results are shown in the two-way table below.

	Under 40	Over 40	Totals
Prefer Cats	28	63	91
Prefer Dogs	51	58	109
Totals	79	121	200

A person under 40 years of age is selected at random.

What is the probability, to the nearest percentage, that this person prefers cats as a pet?

A.   14%

B.   31%

C.   35%

D.   55%

14 Employees at a finance company take an IQ test. It is found that the lowest score of any employee was in the seventh decile.

Which of the following most accurately represents the region in which the test scores of the employees lie?

A.

B.

C.

D.

15

8 cm 8 cm   Not to scale

θ

10 cm
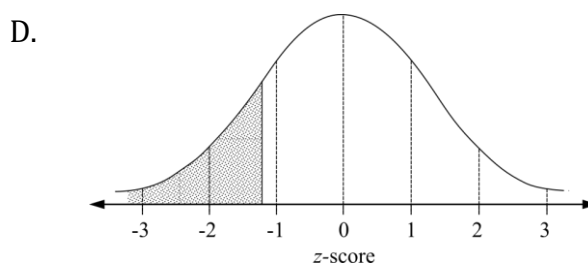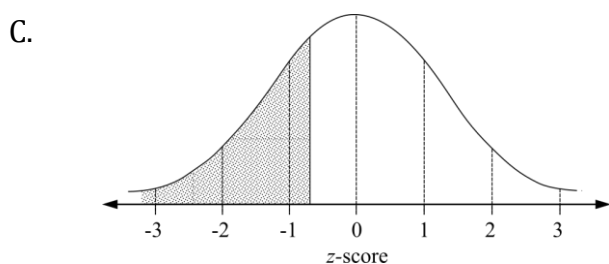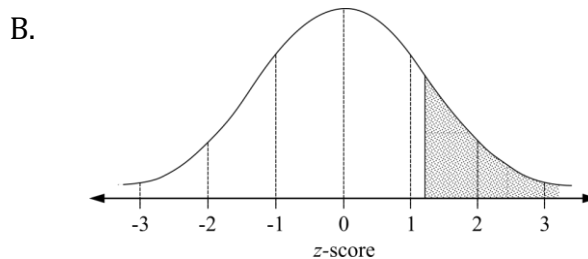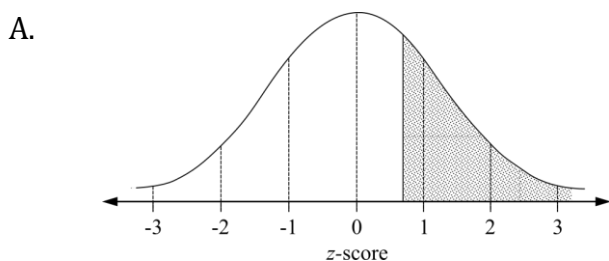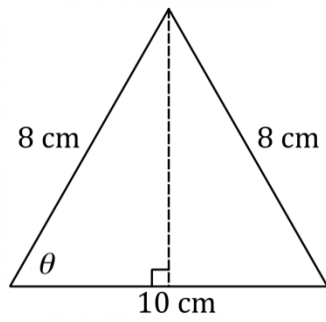
What is the size of the angle θ (correct to the nearest minute) in the isosceles triangle?

A.   36°52′

B.   38°41′

C.   51°19′

D.   65°8′

End of Section I

Mathematics Standard 2

_____

Section II

85 marks
Attempt Questions 16 – 36
Allow about 2 hours and 5 minutes for this section

Instructions

- Write your name 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.
  If you use this space, clearly indicate which question you are answering.

Please turn over

Question 16 (4 marks)

A group of students was surveyed and data relating to the types of pets they owned was collected. The Pareto chart shows the data collected. The column representing the number of students owning pet fish has been removed.

Types of pet owned
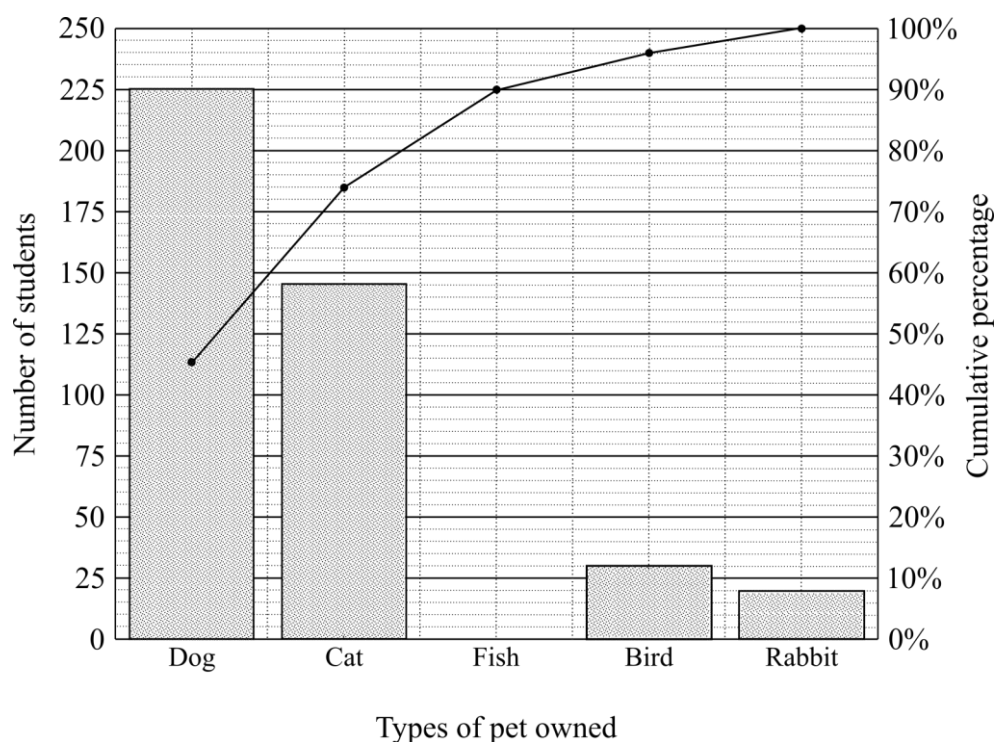
(a) How many students own a pet dog or cat? **1**

....

....

(b) Complete the Pareto chart, showing the number of students who own a pet fish. **3**

....

....

....

....

Question 17 (2 marks)

Tom owns 500 shares in a tech company called Pear. The total value of his shares is $5 630, and he receives a dividend of 84.45 cents per share.

Calculate the dividend yield.

2

....

....

....

....

....

....

....

....

....

Question 18 (2 marks)

A park ranger wants to determine the number of brumbies in Kosciuzko national park.
On her first visit she captures, tags and releases 40 brumbies. A few months later the park ranger captures 60 brumbies and notices that 15 of them had already been tagged.

2

Using the capture-recapture method, what is the estimated number of brumbies in the Kosciuzko national park?

....

....

....

....

....

....

Question 19 (3 marks)

The table below shows the distances between seven towns ($A - G$) by rail.

	A	B	C	D	E	F	G
A	–	30	–	–	–	–	45
B	30	–	65	–	–	–	25
C	–	65	–	45	30	40	20
D	–	–	45	–	40	–	–
E	–	–	30	40	–	15	–
F	–	–	40	–	15	–	10
G	45	25	20	–	–	10	–

(a) Draw a network diagram to represent the information given in the table. **2**

(b) The government wishes to use the minimum amount of railway possible while ensuring that all towns can be accessed. **1**

What is the minimum length of railway required to be built?

....

....

....

....

Question 20 (4 marks)

The table below shows the income tax rates for the 2022–2023 financial year.

4

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

For the 2022–2023 financial year, Scott had a taxable income of $76 400.
During the year, he paid $405 per week in Pay as you go (PAYG) tax.
Scott is also required to pay the 2% Medicare levy.

Calculate whether Scott is required to pay more income tax, or receive a refund, and by how much?

....

....

....

....

....

....

....

....

....

Question 21 (6 marks)

Chloe borrowed $28 000 from the bank to buy a new car. The first three months of loan repayments are shown below.

			This table assumes the same number of days in each month.	
Amount borrowed	$28 000			
Annual interest rate (r)	6%		$I = Prn$ or $I = P \times \dfrac{r}{12}$	
Monthly repayment (R)	$1100			
Month n	Principal P	Interest I	$P + I$	$P + I - R$
1	$28 000.00	$140.00	$28 140.00	$27 040.00
2	$27 040.00	$135.20	$27 175.20	$26 075.20
3	$26 075.20	$130.38	$26 205.58	$25 105.58

(a) How much interest did Chloe pay in the first three months? **2**

....

....

....

(b) How much of the principal would be repaid after the 4th payment? **2**

....

....

....

....

....

(c) If Chloe decided to increase the 4th payment to $11 100.
How much interest would she save in the 5th month? **2**

....

....

....

....

Question 22 (4 marks)

A master painter takes 4 hours to paint a wall and expects to be paid $45 per hour for his work. His apprentice takes 6 hours to paint the same sized wall and expects to be paid $20 per hour.

How much will it cost to hire both the master painter and his apprentice to paint the wall together?

....

....

....

....

....

....

....

....

....

....

....

....
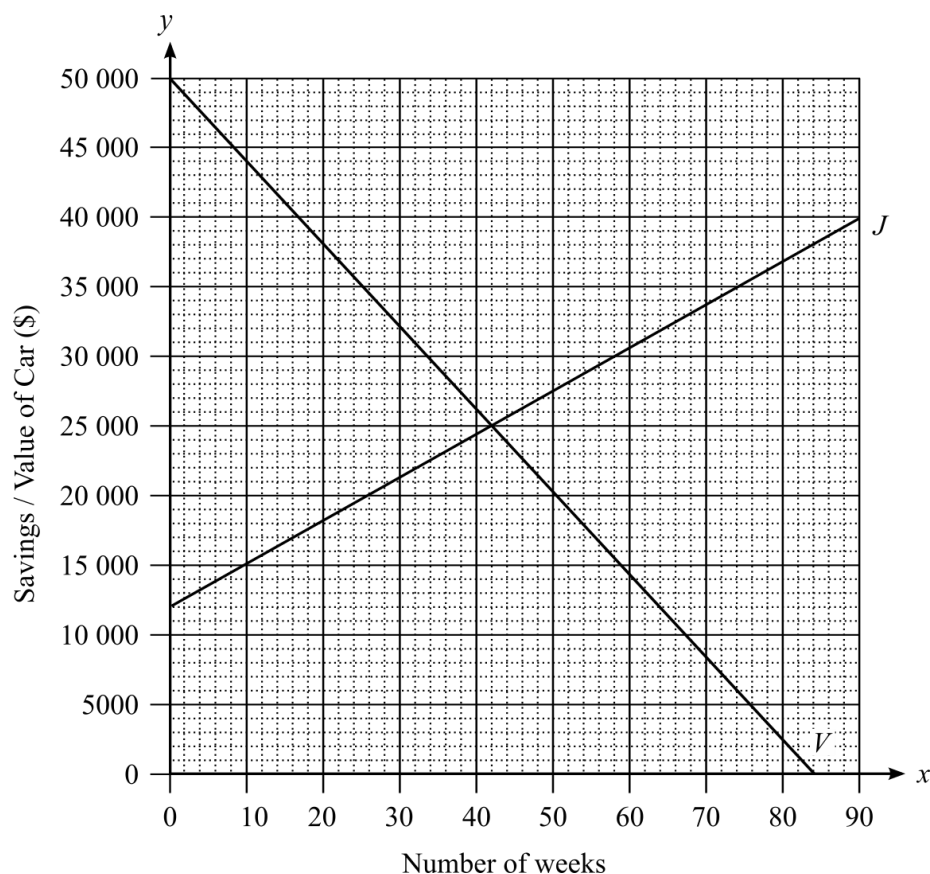
Question 23 (5 marks)

Jack is saving up to buy his uncle's used car. Jack's uncle decides to depreciate the car using the straight-line method.

The linear graphs representing Jack's savings account (J) and the value of his uncle's car (V) are shown.

(a) What is the initial difference between Jack's savings and the value of the car?   **2**

....

....

(b) How long does it take for Jack to be able to afford the car?   **1**

....

....

(c) With reference to the graph, how much money does Jack save per week?   **2**

....

....

....

Question 24 (3 marks)

Jake uses a credit card that charges 22% per annum interest, compounded daily. The card does not have an interest free period and interest is charged on the amount owing, including the day of purchase.

At the beginning of the month of March, Jake owed $900 on his credit card. On the 10th of March, he purchased a phone for $799.

Calculate the amount owing on Jake's credit card at the end of March.

3

....

....

....

....

....

....

....

....

....

....

....
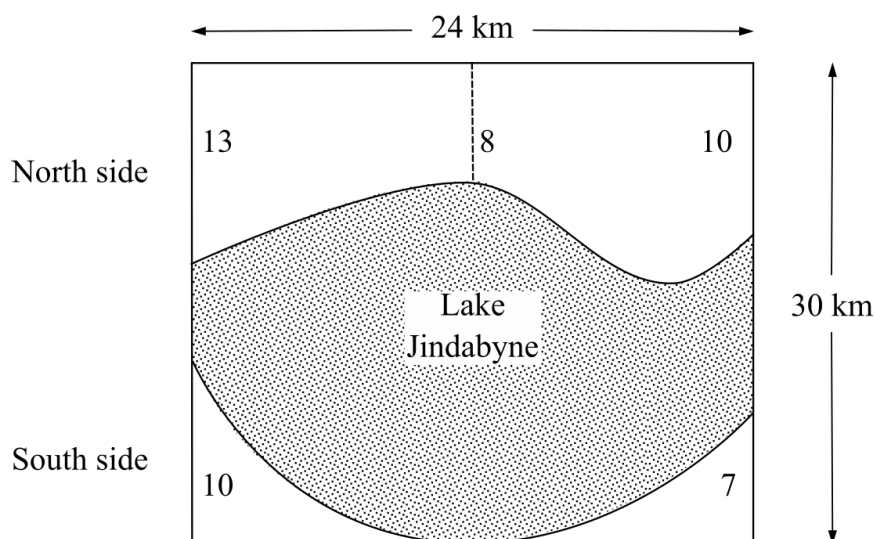
Question 25 (4 marks)

A surveyor wishes to calculate the surface area of Lake Jindabyne. She maps out a rectangular section that encloses the lake. All measurements are in kilometres.

(a) Using two applications of the trapezoidal rule, find an approximation for the area of the section of land mapped out on the **South** side of the lake.

2

....

....

....

....

....

(b) Hence, calculate the area of the surface of Lake Jindabyne.

2

....

....

....

....

....

Question 26 (5 marks)

Samantha lives with her parents and two siblings. Every evening her parents watch television together for 2 hours and Samantha and her siblings are on each of their devices for 4 hours.

The television consumes 250 watts per hour and each of the children's devices consumes 120 watts per hour.

(a) How much electricity, in kilowatt-hours, is consumed by the household each week? **3**

....

....

....

....

(b) If the average peak rate for electricity is $0.12/kWh and the household receives a 20% discount for paying all their bills on time, how much does it cost to run the television and children's devices each year? **2**

....

....

....

....

....

Question 27 (6 marks)

The activity table below shows the relevant stages of a construction project, their duration and interdependencies.

Activity	Immediate Prerequisite(s)	Duration in days
A	—	2
B	A	5
C	—	4
D	B, C	2
E	D	3
F	E	1
G	F	3

(a) By drawing an activity chart, determine the minimum time for the project to be completed.

3

Minimum completion time = ...

(b) Identify the activities in the critical path.

2

....

....

(c) Determine the float time of the non-critical activity

1

....

....

Question 28 (2 marks)

Charlie has completed three assessment tasks for Mathematics with a mean mark of 76%.

What mark, out of 100, does he need to achieve in his next assessment task to increase his mean mark to 80%?

2

....

....

....

....

....

....

....

....

....

Question 29 (5 marks)

The diagram shows the location of three cafés.

Café *B* is 7.5 km due south of Café *A*, Café *C* is 3 km from Café *B*, and the bearing of Café *C* from Café *B* is 045˚.
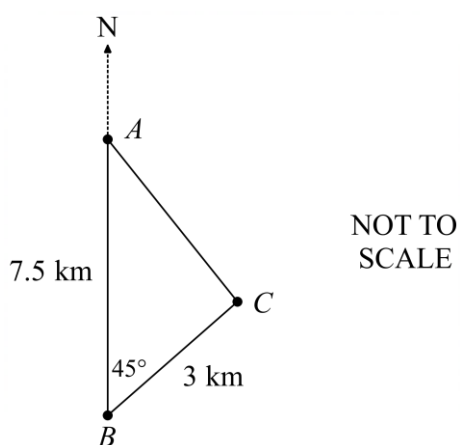
(a) Calculate the distance from Café *A* to Café *C*. Answer correct to 2 decimal places.

2

....

....

....

....

(b) Find the bearing of Café *A* from Café *C*. Answer to the nearest degree.

3

....

....

....

....

....

Question 30 (3 marks)

Gloria invests $5000 at the beginning of each quarter into an account earning interest at a rate of 4% per annum, compounding quarterly.

The amount in the account immediately after the nth contribution can be determined using the recurrence relation

$$A_n = A_{n-1}(1.01) + 5000(1.01),$$

where $n = 1,2,3, \dots$ and $A_0 = 0.$

(a)   Use the recurrence relation to find the amount of money in the account at the end of the third quarter.
   Answer to the nearest cent.   **2**

....

....

....

....

....

....

....

....

(b)   Calculate the amount of interest earned in the first three quarters.   **1**

....

....

....

....

....

....

....

Question 31 (4 marks)

Dr Auz conducts research into the resting heart rates of cyclists and weightlifters. He constructs a parallel stem-and-leaf plot to compare the resting heart rates of 200 cyclists and 200 weightlifters.
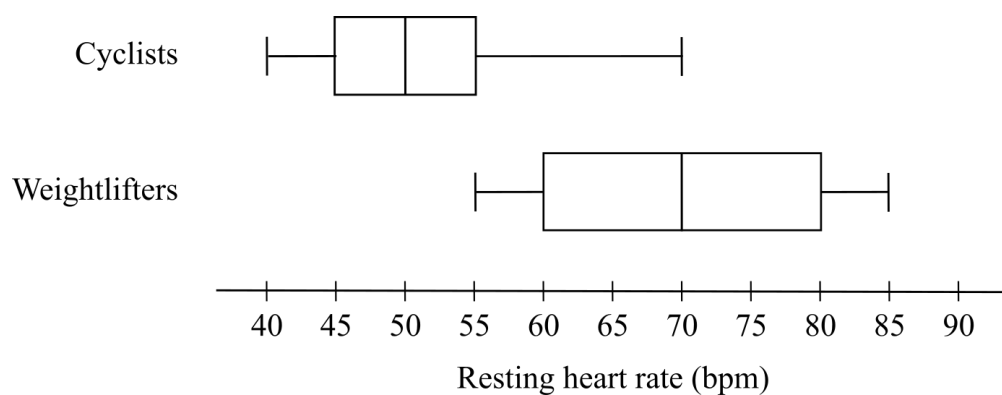
(a) Compare the shape of the distribution of the resting heart rates of the cyclists to that of the weightlifters.

2

....

....

....

(b) Dr Auz concludes that 50 cyclists have resting heart rates in the same range as 150 weightlifters.

2

Is Dr Auz correct? Justify your answer with appropriate calculations.

....

....

....

....

....

....

Question 32 (7 marks)

A healthy human body temperature is 37.0° C.

Eight randomly selected people were examined by medical staff. The difference in their body temperature from 37.0°C (in degrees) and resting heart rate (in beats per minute) were recorded.

Temperature difference from 37ºC (x)	−0.2	−0.3	−0.3	−0.2	−0.1	0	0.2	0.5
Heart rate (y)	63	77	70	74	65	78	79	86

(a) Some of the points have not been plotted on the graph below. Complete the scatterplot by adding the remaining unplotted points from the table. **2**

Temperature difference from 37° C
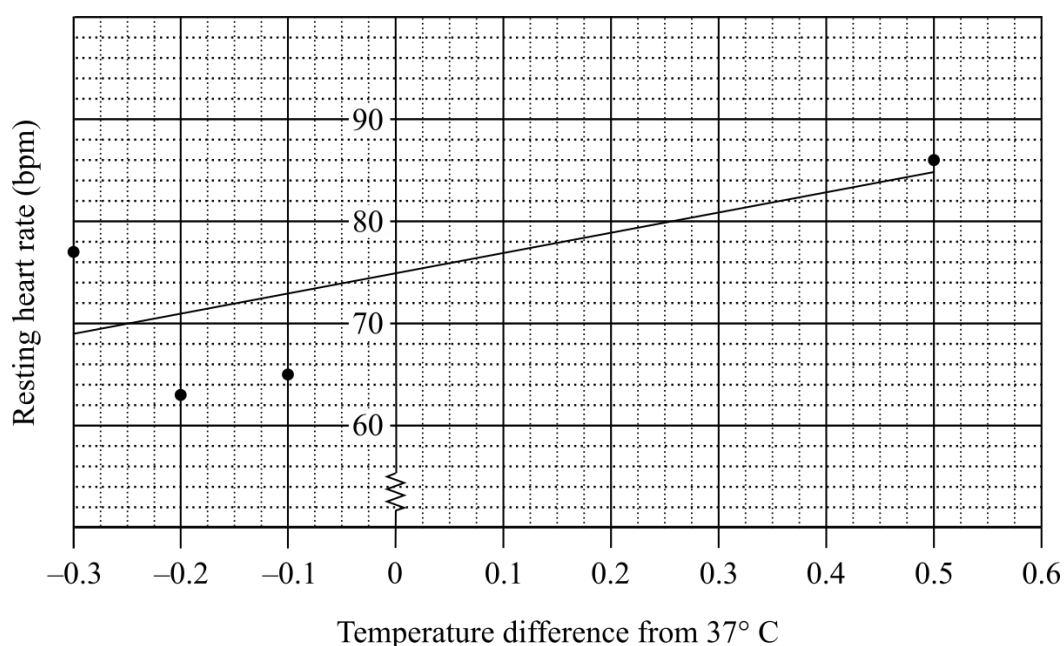
(b) A line of best fit has been plotted in the graph in part (a). Find the equation of this line. **2**

....

....

....

....

....

....

....

Question 32 continues on page 28

Question 32 (continued)

(c)   By using the equation of the line of best fit, predict the resting heart rate of a   **2**
person with a body temperature of 37.3° C.
Give your answer correct to the nearest whole number.

....

....

....

....

(d)   Explain why it would not be reliable to use the line of best fit to predict the   **1**
resting heart rate of a person with a body temperature of 37.6° C.

....

....

....

....

....

....

End of Question 32

Please turn over

Question 33 (4 marks)

A feeding trough is designed in the shape of a half cylinder of diameter 60 cm, and length 2.1 m as shown below.
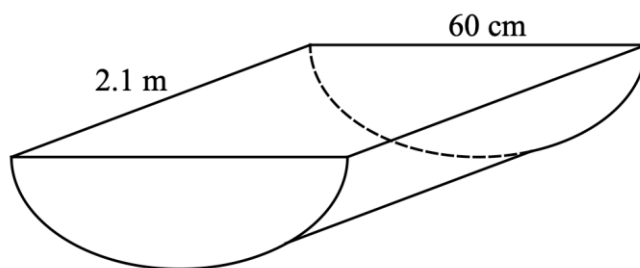
(a) Find the volume of the trough.
Answer in centimetres, correct to 2 decimal places.

    2

....

....

....

....

....

(b) The trough is to be made from sheet metal and is open at the top.
Find the area of sheet metal required.
Answer to the nearest centimetre.

    2

....

....

....

....

....

....

Question 34 (3 marks)

Vicky purchases a new oven for $9 500 for her baking business. She will replace the oven in ten years, at which time she can trade in her oven to reduce the price of her next oven. Vicky investigates using the straight-line depreciation method and declining balance method of depreciation. **3**

She will select the method that provides the greatest salvage value after ten years. The rates of depreciation are listed below.

- Straight-line depreciation: $750 per year
- Declining balance method: 20% per year

The graph below shows the salvage value of the oven using the declining balance method.
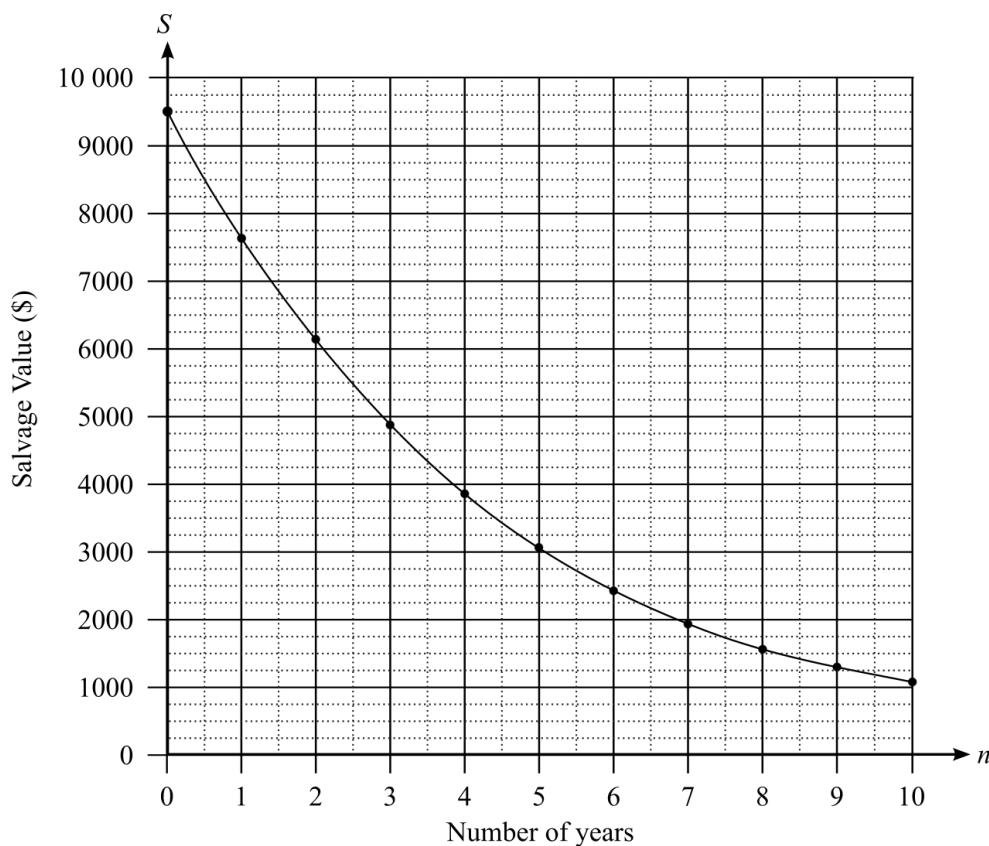
Draw, on the grid above, the salvage value of the oven over time using the straight-line depreciation method. Hence, which method of depreciation should Vicky select?

....

....

....

....

....

Question 35 (5 marks)

The heights of adults in the Northern Hemisphere are normally distributed with a mean of 167 cm and a standard deviation of 5 cm.

The heights of adults in the Southern Hemisphere are normally distributed with a mean of 171 cm and a standard deviation of 6.0 cm.

(a) Joanna is 177 cm tall and lives in the Southern Hemisphere.   2

What percentage of adults in the Southern Hemisphere are taller than Joanna?

....

....

....

....

(b) Joanna's friend Naomi has a height such that the z-score for her height in the   3
Northern Hemisphere is the same as the z-score for her height in the Southern Hemisphere.

Naomi makes a claim about the z-scores corresponding to her height in the Northern and Southern Hemispheres:

Less than 0.15% of the world's population are the same height as me.

Using appropriate calculations, explain whether Naomi's claim is correct.

....

....

....

....

....

Question 36 (4 marks)

A farmer divides a paddock into four triangular areas for the purpose of giving his livestock distinct areas in which to graze. The diagram shows the compass radial survey of paddock $ABCD$.

4
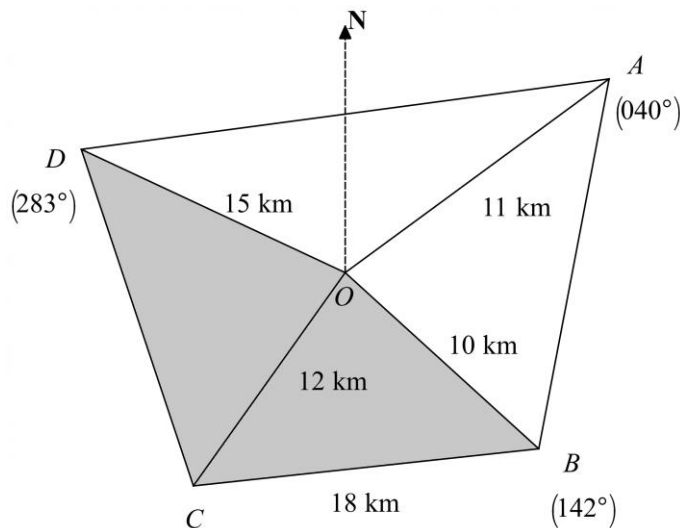
The farmer wishes to house his horses in the shaded region $OBCD$.

Find the area of the shaded region. Give your answer correct to one decimal place.

....

....

....

....

....

....

....

....

....

....

....

End of Paper
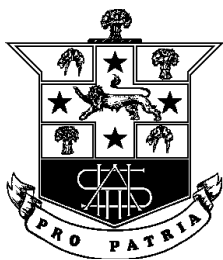
2023 HSC Mathematics Standard 2
Trial Examination Marking Guidelines

Section I

Multiple Choice Answer Key

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

Question 1

$$\text{Median} = \frac{28 + 32}{2}$$
$$= 30$$

Answer: C

Question 2

$$\text{precision} = 0.01 \text{ cm}$$
$$\therefore \text{absolute error} = 0.005 \text{ cm}$$

$$\text{percentage error} = \frac{\text{absolute error}}{\text{measurement}} \times 100\,\% = \frac{0.005}{18.24} \times 100\% = 0.027\% \text{ (to 3 d.p.)}$$

Answer: A

Question 3

A moderate, negative linear association is one in which the gradient of the line of best fit is negative.
In Option C, the points form a straight line with negative slope, which would indicate a correlation coefficient of -1.
Therefore, Option B is the most appropriate.

Answer: B

Question 4

$$40 \times \frac{100}{420} = 9.5 \text{ L (to 1 d.p.)}$$

Answer: C

Question 5

Hanoi is 12 hours ahead of Santiago.

∴ Tracey answers the phone at 6:00 am on Wednesday.

Answer: B

Question 6
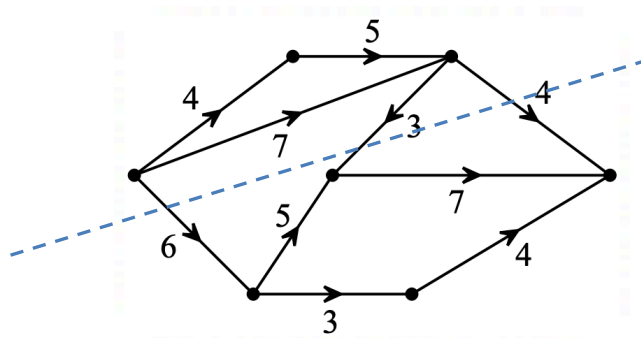
Therefore, the minimum cut capacity is $4 + 3 + 6 = 13$.

Answer: C

Question 7

Line 1: $y-$intercept $= -1$ with gradient $1 \Rightarrow y = x - 1$

Line 2: $y-$intercept $= 3$ with gradient $-\frac{3}{4} \Rightarrow y = -\frac{3}{4}x + 3$

Answer: B

Question 8

$t = kh$

$120 = k \times 45 \implies k = \frac{8}{3}$

$t = \frac{8}{3} \times 63 = 168$

Answer: D

Question 9

Depreciating by \$40 000 over 5 years is equivalent to \$8 000 per year.

Answer: C

Question 10

Income $= 3 + 1.75n$

Cost $= 0.25n$

Profit $= I - C$

$ = 3 + 1.75n - 0.25n$

$ = 3 + 1.5n$

Answer: D

Question 11

$\pi r^2 = \pi R^2 - A$

$r^2 = \dfrac{\pi R^2 - A}{\pi}$

$\therefore r = \sqrt{\dfrac{\pi R^2 - A}{\pi}}$

Answer: A

Question 12

$5000 \div 12.336 = \$405.32$ (to 2 d.p.)

Answer: D

Question 13

$\dfrac{28}{79} \times 100\% = 35.44303797\% = 35\%$ (nearest percent)

Answer: C

Question 14

Since the lowest score is in the 7th decile, it must lie to the left of the line representing the z -score 1.

In Option B, the minimum score lies at least in the 8th decile.

Answer: A

Question 15

Two congruent triangles

$\cos\theta = \dfrac{5}{8}$

$\quad \theta = 51.3178$

$\qquad = 51°19'$ (nearest minute)
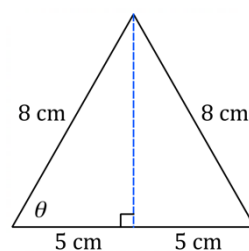
Answer: C

Section II

Question 16 (a)

Criteria	Marks
• Provides the correct solution	1

Number of students who own a pet cat or dog:

$= 225 + 145$

$= 370$

Question 16 (b)

Criteria	Marks
• Provides the correct solution	3
• Attempts to use the number of students who own a pet cat or dog as a percentage of the total number of students	2
• Correctly identifies the percentage of students who own pet fish	1

Percentage of students who own a pet cat or dog $= 74\,\%$.

Total number of students $= 370 \div 74 \times 100$

$= 500$

Number of students who own a pet fish $= 16\% \times 500$

$= 80$
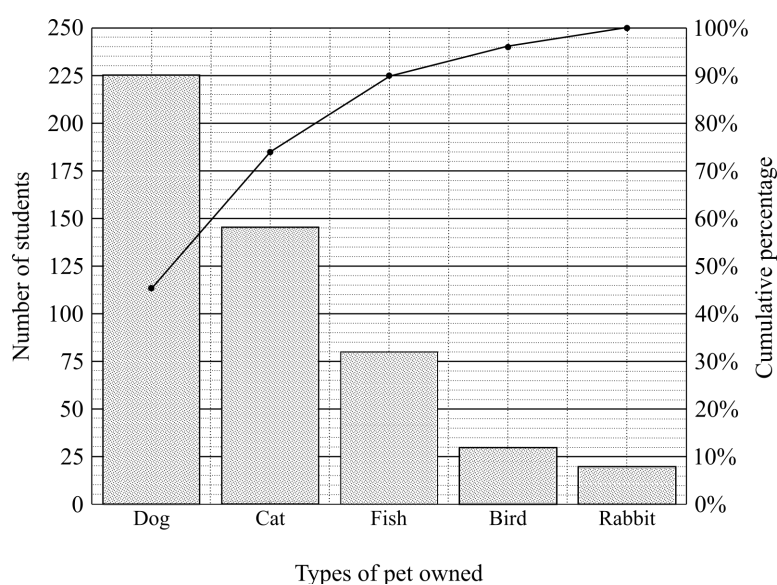
Question 17

Criteria	Marks
• Provides the correct solution	2
• Correctly finds the total dividend earned, or equivalent merit	1

$$\text{Dividend yield } = \frac{500 \times 0.8445}{5630} \times 100\,\% = 7.5\,\%$$

Question 18

Criteria	Marks
• Provides the correct solution	2
• Progress towards solution	1

$$\frac{40}{P} = \frac{15}{60}$$
$$P = \frac{40 \times 60}{15}$$
$$\therefore P = 160$$

Question 19 (a)

Criteria	Marks
• Provides correct answer	2
• Diagram shows at least two correct edges	1
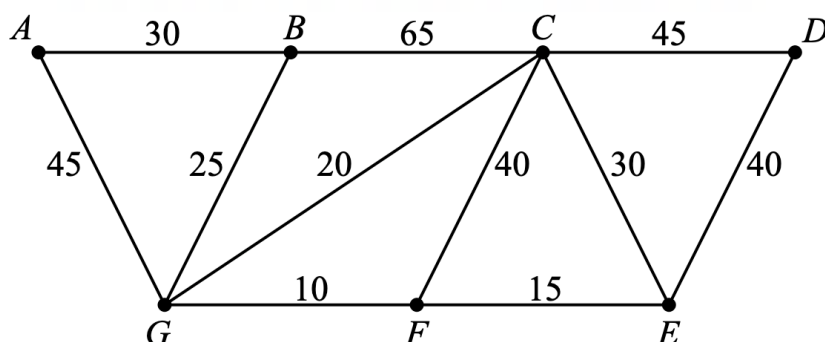
Question 19 (b)

Criteria	Marks
• Provides correct answer	1

Length of minimum spanning tree $= 10 + 15 + 20 + 25 + 30 + 40 = 140$

Question 20

Criteria	Marks
• Provides the correct solution	4
• Finds income tax payable and Medicare levy, and PAYG total, or equivalent merit	3
• Finds income tax payable and Medicare levy, or equivalent merit	2
• Finds income tax payable or Medicare levy, or equivalent merit	1

Income Tax payable $= 5092 + 0.325 \times \left(76400 - 45000\right) = \$15297$

Total Tax Payable $= \$15297 + \left(2\% \times 76400\right) = \$16825$

PAYG so far $= 52 \times 405 = \$21060$

Therefore, Scott should receive a refund of $21060 - 16825 = \$4235$.

Question 21 (a)

Criteria	Marks
• Provides the correct solution	2
• Progress towards solution	1

Interest = 140.00 + 135.20 + 130.38
$\qquad$ = \$405.58

∴ Chloe paid \$405.58 interest.

Question 21 (b)

Criteria	Marks
• Provides the correct solution	2
• Calculates interest	1

4th month: P = \$25 105.58

$I = Prn = 25\,105.58 \times \dfrac{0.06}{12}$

$\qquad = 125.5279\ldots = \$125.53$ (nearest cent)

$P + I - R = 25\,105.58 + 125.53 - 1100$

$\qquad\qquad = \$24\,131.11$

Repaid = 28 000 − 24 131.11
$\qquad$ = \$3868.89

∴ Chloe has repaid \$3868.89

Question 21 (c)

Criteria	Marks
• Provides the correct solution	2
• Progress towards solution	1

Interest with 4th payment of \$1100

$I = Prn$

$\quad = 24\,131.11 \times \dfrac{0.06}{12}$

$\quad = 120.6555\ldots = \$120.66$ (nearest cent)

Interest with 4th payment of \$11 100 (extra \$10 000)

$I = Prn$

$\quad = (24\,131.11 - 10\,000) \times \dfrac{0.06}{12}$

$\quad = 70.6555\ldots = \$70.66$ (nearest cent)

Interest saving = 120.66 − 70.66 = \$50

∴ Chloe saved \$50

Question 22

Criteria	Marks
• Provides the correct solution	4
• Finds the time taken to paint the wall together	3
• Finds how much of the wall can be painted in one hour when working together, or equivalent merit	2
• Finds the fraction of the wall that can be painted in one hour by any person, or equivalent merit	1

In one hour, the master painter can paint $\frac{1}{4}$ of the wall.

In one hour, the apprentice painter can paint $\frac{1}{6}$ of the wall.

If they paint together, in one hour, they can paint $\frac{1}{4} + \frac{1}{6} = \frac{5}{12}$ of the wall.

Hence, they will require $1 \div \frac{5}{12} = 2.4$ hours.

$\therefore$ it will cost $2.4 \times (45 + 20) = \$156$ to hire both people to paint the wall.

Question 23 (a)

Criteria	Marks
• Provides the correct solution	2
• Identifies the initial value of Jack's savings, or equivalent merit	1

Difference $= 50\ 000 - 12\ 000$
$\qquad\quad = \$38\ 000$

Question 23 (b)

Criteria	Marks
• Provides the correct solution	1

42 weeks.

Question 23 (c)

Criteria	Marks
• Provides the correct solution	2
• Attempts to find the gradient of the line J, or equivalent merit	1

Jack saves \$28 000 in 90 weeks.
∴ Jack saves \$311.11 per week.

Question 24

Criteria	Marks
• Provides the correct solution	3
• Correctly applies the compound interest formula, or equivalent merit	2
• Correctly finds the number of days from 10th March to 31st March inclusive	1

Initial $900 owing $= 900\left(1 + \frac{0.22}{365}\right)^{31} = \$916.97$

Phone purchased for $799 $= 799\left(1 + \frac{0.22}{365}\right)^{22} = \$809.66$

$\therefore$ total amount owing$= \$916.97 + \$809.66 = \$1\,726.33$

Question 25 (a)

Criteria	Marks
• Provides correct solution	2
• Finds the width of each subinterval, or equivalent merit	1

Area of South side $= \frac{12}{2}\big((10 + 0) + (0 + 7)\big) = 102 \text{ km}^2$

Question 25 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the area North of Lake Jindabyne	1

Area of North side $= \frac{12}{2}\big((13 + 8) + (8 + 10)\big) = 234 \text{ km}^2$

Surface of Lake Jindabyne $= \big(24 \times 30\big) - \big(102 + 234\big) = 384 \text{ km}^2$

Question 26 (a)

Criteria	Marks
• Provides correct solution	3
• Finds the amount of electricity consumed by using devices	2
• Finds the amount of electricity consumed by watching television	1

Television $= 250 \times 7 \times 2 = 3\ 500$ watts

Devices $= 3 \times 120 \times 7 \times 4 = 10\ 080$ watts

Total electricity consumed $= 3500 + 10080 = 13\ 580$ Wh $= 13.58$kWh

Question 26 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the amount of electricity consumed in one year	1

Total electricity consumed in one year $= 13.58 \times 52 = 706.16$ kWh

Cost Cost $= 706.16 \times 0.12 \times 0.8 = \$67.79$

Question 27 (a)

Criteria	Marks
• Provides the correct solution	3
• Draws a network diagram with all activities correct	2
• Draws a network diagram with some activities correct	1
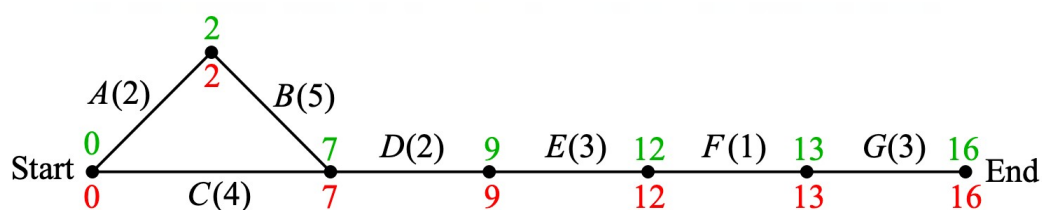
minimum time = 16 days

Question 27 (b)

Criteria	Marks
• Provides the correct answer	2
• Performs a backward scan	1

A-B-D-E-F-G

Question 27 (c)

Criteria	Marks
• Provides the correct solution	1

Float time $= 7 - 4 = 3$ days

Question 28

Criteria	Marks
• Provides the correct solution	2
• Finds the sum of the scores from the first three tasks, or equivalent merit	1

In the first three assessments, Charlie's total score was $76 \times 3 = 228$.

With the fourth task, $\frac{228+x}{4} = 80$

$\therefore x = 92$

Question 29 (a)

Criteria	Marks
• Provides correct solution	2
• Applies the Cosine Rule, or equivalent merit	1

$AC^2 = 7.5^2 + 3^2 - 2 \times 7.5 \times 3 \times \cos 45°$
$AC^2 = 33.43019485$
$\therefore AC = 5.78 \; (2 \text{ d.p.})$

Question 29 (b)

Criteria	Marks
• Provides correct solution	3
• Finds the size of angle A, or equivalent merit	2
• Applies the Sine Rule, or equivalent merit	1

$\dfrac{\sin A}{3} = \dfrac{\sin 45^0}{5.782}$

$\sin A = \dfrac{3\sin 45^0}{5.782}$

$A = \sin^{-1}\left(\dfrac{3\sin 45^0}{5.782}\right)$

$A = 21.52^0$

Bearing from C to $A = 360^0 - 21.52^0 = 338^0$ (to the nearest degree)

Question 30 (a)

Criteria	Marks
• Provides correct solution	2
• Correctly applies the recurrence formula once, or equivalent merit	1

$A_1 = 0 \times (1.01) + 5000 \times (1.01) = \$5050$

$A_2 = 5050 \times (1.01) + 5000 \times (1.01) = \$10\ 150.5$

$A_3 = 10\ 150.5 \times (1.01) + 5000 \times (1.01) = \$15\ 302.01$

Question 30 (b)

Criteria	Marks
• Provides correct solution	1

Interest earned $= 15\ 302.01 - (3 \times 5\ 000) = \$302.01$

Question 31 (a)

Criteria	Marks
• Provides correct answer	2
• Correctly identifies the shape of one group, or equivalent merit	1

The data for cyclists is positively skewed.

The data for weightlifters is symmetrical.

Question 31 (b)

Criteria	Marks
• Provides correct solution with appropriate calculations	2
• Provides correct answer without any justification	1

The common range between the resting heart rates of cyclists and weightlifters is 55 to 70 bpm.

There are $25\% \times 200 = 50$ cyclists in this range and $50\% \times 200 = 100$ weightlifters in this range.

Therefore, Dr Auz is incorrect.

Question 32 (a)

Criteria	Marks
• Provides correct answer	2
• Correctly plots at least two points	1
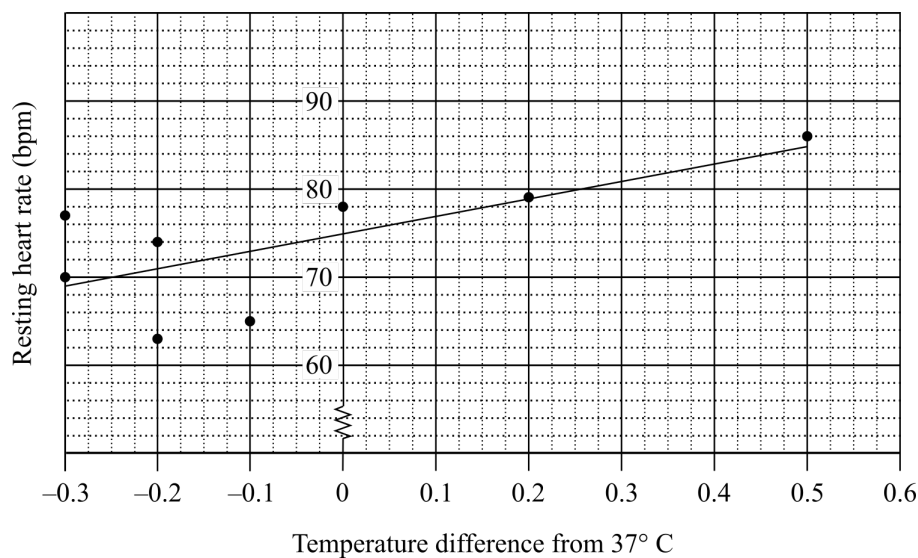
Question 32 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the correct gradient OR y - intercept	1

selecting points $(-0.25,\ 70)$ and $(-0.15,\ 72)$:

gradient: $m = \dfrac{2}{0.1} = 20$

$y = 20x + c$

$70 = 20(-0.25) + c$

$\therefore c = 75$

Hence, the equation of the line of best fit is $y = 20x + 75$

Note - Other options are available depending upon the choice of points.

Question 32 (c)

Criteria	Marks
• Provides correct solution	2
• Substitutes the correct value of x into **their** equation	1

A temperature of $37.3^0C \rightarrow x = 0.3$

$y = 20(0.3) + 75 = 81$ beats per minute

Question 32 (d)

Criteria	Marks
• Provides valid reason	1

It would not be reliable to use the line of best fit to predict the heart rate of a person with a body temperature of $37.6°$ as 0.6 is outside of the original range of the dataset i.e., the prediction would be an extrapolation.

Question 33 (a)

Criteria	Marks
• Provides correct answer	2
• Correctly converts dimensions into centimetres, or equivalent merit	1

$$\text{Volume} = \frac{1}{2} \times \pi \times 30^2 \times 210 = 296\ 880.51 \text{ cm}^3 \text{ (to 2d.p)}$$

Question 33 (b)

Criteria	Marks
• Provides correct solution	2
• Finds correct expression for the surface area of half a cylinder.	1

$$\text{Surface Area} = \pi \times 30^2 + \pi \times 30 \times 210 = 22\ 619 \text{ cm}^2 \text{ (nearest cm}^2)$$

Question 34

Criteria	Marks
• Provides correct solution with appropriate justification	3
• Straight line passes through the correct vertical intercept and other correct point, or equivalent merit	2
• Straight line passes through the correct vertical intercept, or equivalent merit	1
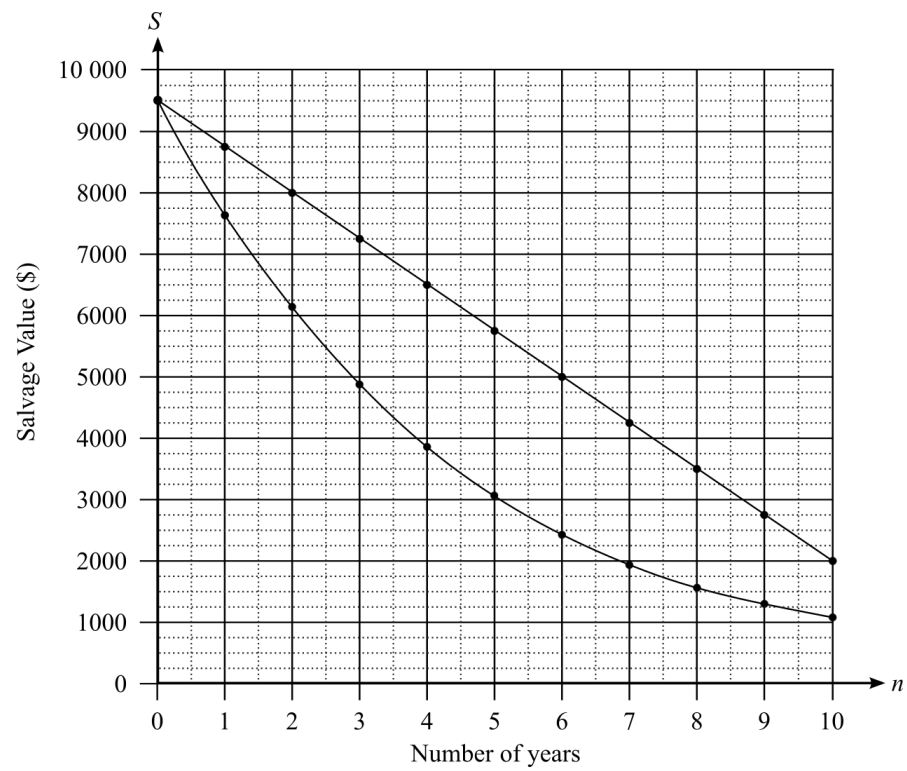
Within the first 10 years of purchase, the straight light method of depreciation retains a greater salvage value than that of the declining balance method.

Hence, Vicky should choose the straight-line method of depreciation.

Question 35 (a)

Criteria	Marks
• Provides correct solution	2
• Finds the relevant empirical proportions of the normal distribution	1

$$100\% - 50\% - \frac{68\%}{2} = 16\%$$

Question 35 (b)

Criteria	Marks
• Provides correct solution, with justification	3
• Finds Naomi's height, or equivalent merit	2
• Equates the z score corresponding to Naomi's height in both hemispheres, or equivalent merit	1

$$\frac{x - 167}{5} = \frac{x - 171}{6}$$
$$6x - 1002 = 5x - 855$$
$$\therefore x = 147$$

Therefore, Naomi is correct since her height is less than three standard deviations below the mean in both the Northern and Southern hemispheres.

Question 36

Criteria	Marks
• Provides correct solution	4
• Finds the area of either triangle *BOC* **or** *COD*, or equivalent merit	3
• Finds the size of ∠*COD*, or equivalent merit	2
• Finds the size of ∠*BOC*, or equivalent merit	1

Let ∠BOC = θ

$$\cos\theta = \frac{12^2 + 10^2 - 18^2}{2 \times 12 \times 10}$$

$$\theta = \cos^{-1}\left(\frac{12^2 + 10^2 - 18^2}{2 \times 12 \times 10}\right)$$

$$\therefore \ \theta = 109.4712^0$$

$$\angle COD = 360^0 - 117^0 - 102^0 - 109.4712^0 = 31.5288^0$$

$$\text{Area } \Delta BOC = \frac{1}{2} \times 10 \times 12 \times \sin 109.4712^0 = 56.5685 \text{ km}^2$$

$$\text{Area } \Delta COD = \frac{1}{2} \times 12 \times 15 \times \sin 31.5288^0 = 47.0634 \text{ km}^2$$

$$\therefore \text{Shaded area} = \ 56.5685 \text{ km}^2 + 47.0634 \text{ km}^2 = 103.6 \text{ km}^2 \text{ (to 1 d. p.)}$$