Neap

Trial Examination 2022

HSC Year 12 Mathematics Standard 2

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

Total Marks: 100

SECTION I – 15 marks (pages 2–6)
- Attempt Questions 1–15
- Allow about 25 minutes for this section

SECTION II – 85 marks (pages 7–29)
- Attempt Questions 16– 38
- Allow about 2 hours and 5 minutes for this section

SECTION I

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

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

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1 A rectangle has a length of 0.0005 mm and a width of 0.0002 mm.
What is the area of the rectangle in standard form?

A. 1×10^{-7} mm^2

B. 1×10^{-3} mm^2

C. 1×10^{3} mm^2

D. 1×10^{7} mm^2

2 Consider the network diagram.
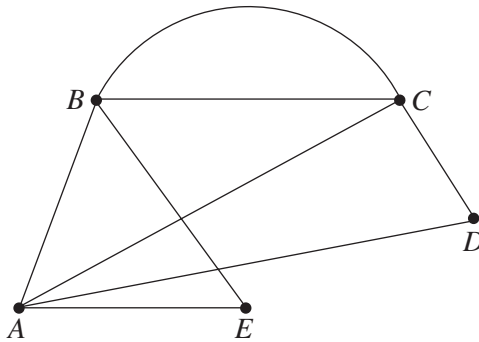
How many edges does the network have?

A. 5

B. 6

C. 7

D. 8

3 Two variables, x and y, have a correlation coefficient of –1.
This means that the two variables

A. have been interpolated.

B. have been extrapolated.

C. are perfectly positively correlated.

D. are perfectly negatively correlated.

4   Consider the triangle.

150

x

NOT TO
SCALE

20°
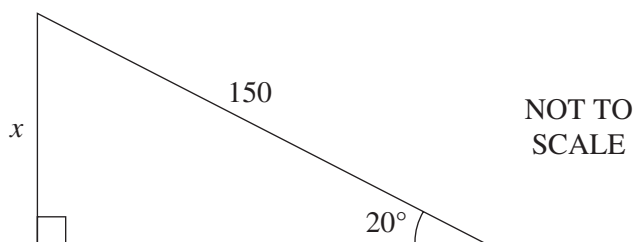
Which of the following gives the value of *x*?

A. $150\cos20°$

B. $\dfrac{150}{\sin20°}$

C. $\dfrac{150}{\cos20°}$

D. $150\sin20°$

5   Alessia works 42 hours per week at a rate of $32.50 per hour. She decides to take four weeks of annual leave. While she is on annual leave, she is paid a loading of 17.5% on her wage.

What is Alessia's total wage for the period of time that she is on annual leave?

A. $955.50

B. $1365

C. $5460

D. $6415.50

6   The scale of a map is 1 cm = 125 m.

If the actual distance between two points is 650 m, what is the distance between these points on the map?

A.   0.2 cm

B.   2 cm

C.   2.5 cm

D.   5.2 cm

7   Ian invests $25 000 in a savings account. He earns interest at 5.5% per annum, compounded biannually.

What is the future value of Ian's investment after five years, to the nearest dollar?

A. $28 632

B. $32 674

C. $32 791

D. $42 704

8 A straight line has the equation $4x - 5y + 35 = 0$.

What is the gradient and y-intercept of the line?

A. gradient $= -\dfrac{4}{5}$, y-intercept $= \dfrac{1}{7}$

B. gradient $= \dfrac{5}{4}$, y-intercept $= -\dfrac{1}{7}$

C. gradient $= \dfrac{4}{5}$, y-intercept $= 7$

D. gradient $= -\dfrac{5}{4}$, y-intercept $= 7$

9 The amount of a particular medication in an intravenous (IV) solution is 250 mg per 15 mL.
A patient is prescribed 3500 mg of the medication.

How much IV solution should be given to the patient?

A. 0.93 mL

B. 14 mL

C. 21 mL

D. 210 mL

10 The test scores of a Mathematics class and their frequencies are shown in the table.

Score	Frequency
52	4
54	8
56	12
58	2
60	2

Which of the following measures will change if another score of 60 is added to the dataset?

A. mean

B. range

C. median

D. mode

11 In the triangle *ABC*, *AB* has a length of 8 cm, *BC* has length of 12 cm, and angle *ABC* is 32°.
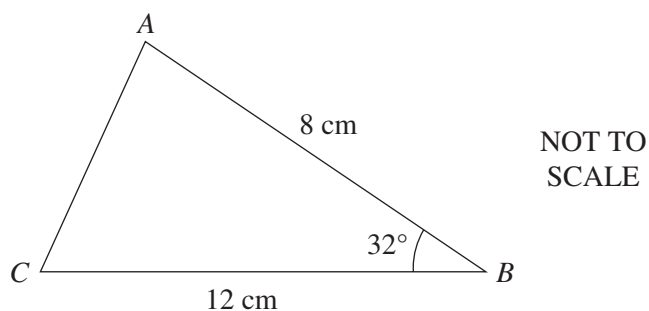
What is the area of triangle *ABC*?

A. 25.4 cm^2

B. 26.6 cm^2

C. 26.7 cm^2

D. 48.0 cm^2

12 The height of a building is measured. It is found to be 480 m, to the nearest 10 m.
The lower and upper limits of the true measurement are, respectively,

A. 450 m and 460 m.

B. 470 m and 490 m.

C. 475 m and 485 m.

D. 400 m and 500 m.

13 Dominic's car uses fuel at a rate of 7.2 L per 100 km for long-distance driving and 10.4 L per 100 km for short-distance driving. Dominic drove his car 851 km to Melbourne. The journey included 112 km of short-distance driving.
How much fuel did Dominic's car use on the journey, correct to the nearest litre?

A. 63 L

B. 64 L

C. 65 L

D. 66 L

14 Last month, Jessica purchased 550 shares at a market price of $4.00 per share. The market price is now $4.60 per share. Jessica receives a dividend of $0.40 per share.
What is the dividend yield?

A. 8%

B. 9%

C. 10%

D. 11%

15   The diagram represents a network with weighted edges.
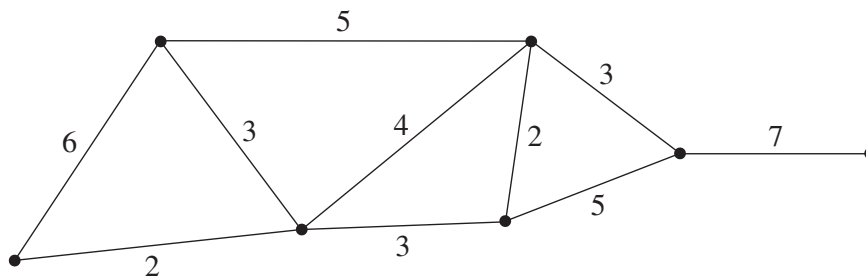
What is the total length of the minimum spanning tree?

A.   17

B.   20

C.   24

D.   27

HSC Year 12 Mathematics Standard 2

Section II Answer Booklet 1

SECTION II

85 marks
Attempt Questions 16–38
Allow about 2 hours and 5 minutes for this section

Booklet 1 — Attempt Questions 16–26 (34 marks)
Booklet 2 — Attempt Questions 27–38 (51 marks)

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided on pages 16–18 of Booklet 1. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 16 (2 marks)

A circular path is to be built around an in-ground spa, as shown in the diagram.   **2**

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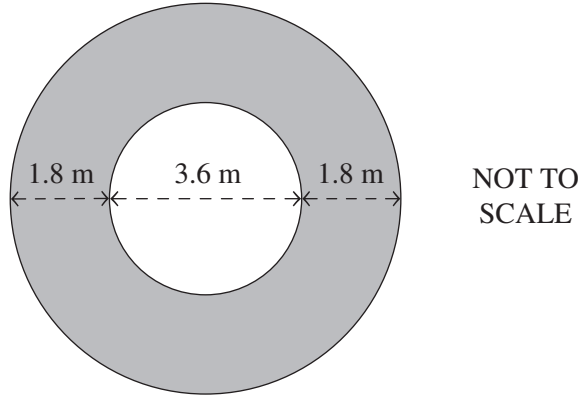
Calculate the area of the path, correct to one decimal place.

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Question 17 (1 mark)

Megan earns \$6125 per month. She needs to use 27% of her yearly salary to make her mortgage   **1**
repayments.

How much will Megan have repaid after one year?

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Question 18 (3 marks)

The table shows the income tax rates for the 2021–2022 financial year.

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	$5092 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

Amanda has a total income of $118 000. Her tax payable is $27 750.

(a)   Determine Amanda's taxable income, correct to the nearest dollar.   **2**

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(b)   How much did Amanda claim as allowable tax deductions?   **1**

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Question 19 (2 marks)

Three unbiased six-sided dice are rolled simultaneously 1080 times.   **2**

How many times would it be expected that all three dice show a 4?

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Question 20 (4 marks)

A swimming pool has been measured to have a length of 10 m and a width of 6 m.

(a)   State the limit of accuracy and absolute error for these measurements.   **2**

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(b)   Calculate the absolute error for the area of the swimming pool.   **2**

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Question 21 (3 marks)

Solve $\dfrac{x+4}{5} - \dfrac{2(x-2)}{3} = 2.$ **3**

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Question 22 (2 marks)

The equations of two lines are shown.

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$$y = 4 - 2x$$
$$3x + 4y = 1$$

Find the point of intersection of the two lines.

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Question 23 (3 marks)

A cylindrical can has a label wrapped around it. The label covers the entire curved surface of the can
The can has a height of 13 cm, as shown in the diagram.

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13 cm   NOT TO
               SCALE
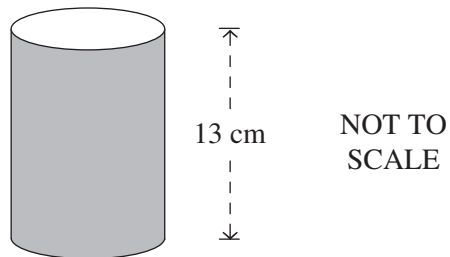
The area of the label is 234 cm^2.

Find the diameter of the can, correct to two decimal places.

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Question 24 (7 marks)

Two hikers decide to leave a campsite (*C*) to visit some natural landmarks in the area. One hiker walks 16 km on a bearing of 65° to see a lake (*L*); the other hiker walks 26 km on a bearing of 285° to reach the top of a mountain (*M*).

(a)   Draw a diagram to display the scenario.   **1**

(b)   Show that the angle between the mountain and the lake is 140°.   **1**

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(c)   Calculate the distance between the mountain and the lake, correct to the nearest kilometre.   **2**

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Question 24 continues on page 13

Question 24 (continued)

(d)   Hence, using your answer from part (c) and the sine rule, find the bearing of the lake   **3**
       from the mountain, correct to the nearest degree.

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End of Question 24

Question 25 (2 marks)

The average flow rate of Stephanie's shower head is 14 litres per minute. Stephanie has two 8-minute   **2**
showers each day. The cost of water usage is $2.55 per kilolitre.

Calculate the yearly cost of Stephanie's showers, correct to the nearest cent.

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Question 26 (5 marks)

Frances achieved a score of 84 on a test. The class scores were normally distributed. The mean of the class scores on the test was 72. Frances's z-score was 1.5.

(a)   What was the standard deviation of the class scores on the test?   **1**

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The class scores were standardised to a mean of 78 and a standard deviation of 6.

(b)   Determine Frances's new moderated score for the test.   **2**

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(c)   If 120 students completed the test, how many students would be expected to receive a moderated mark less than 66?   **2**

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HSC Year 12 Mathematics Standard 2

Section II Answer Booklet 2

**Booklet 2 — Attempt Questions 27–38 (51 marks)**

Instructions	• Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
	• Your responses should include relevant mathematical reasoning and/or calculations.
	• Extra writing space is provided on pages 30–31 of Booklet 2. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 27 (3 marks)

The network diagram shows the distance between suburbs in kilometres.

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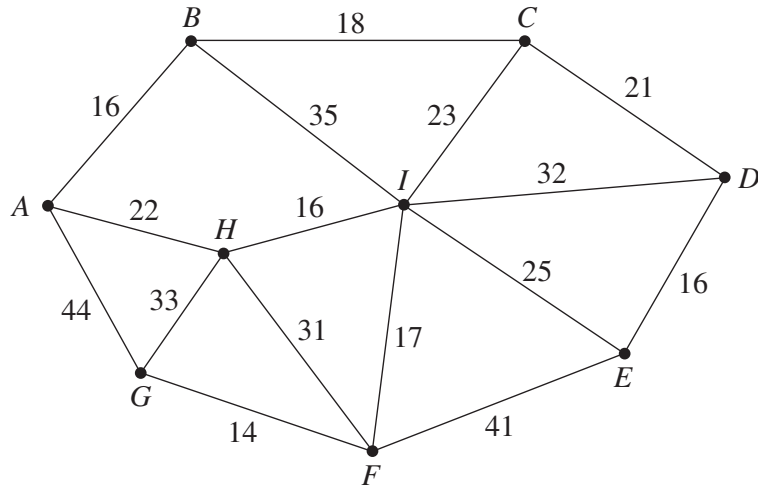
Find the minimum distance that connects all the suburbs.

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Question 28 (3 marks)

Chris has eight blue socks and seven white socks in his drawer. He is rushing while getting ready for work and, without looking, randomly selects two socks from the drawer.

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What is the probability that Chris chooses two socks that are the same colour?

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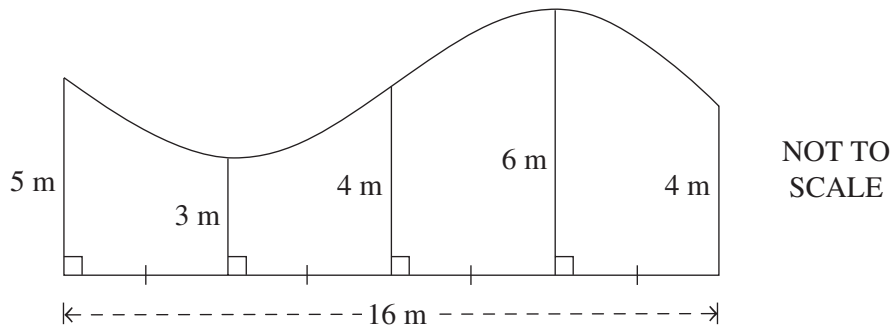
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Question 29 (4 marks)

Luka is installing a pond in his backyard. The pond will have three straight edges and one curved edge. The depth of the pond will be 2 metres throughout. Luka took measurements and drew an overhead view of the pond to assist the builder, as shown in the diagram.

(a)   Using the trapezoidal rule, estimate the area of the bottom of the pond.   **2**

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(b)   Calculate how many litres of water will be required to fill the pond.   **2**

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Question 30 (2 marks)

Richard plays on his game console for three hours every day. The game console uses 350 watts   **2**
of energy per hour. The cost of electricity usage is $0.45 per kWh.

Calculate the yearly cost for Richard to play his game console, correct to the nearest cent.

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Question 31 (8 marks)

Domenica is a furniture maker who builds and sells wooden coffee tables. She has a fixed cost of $360 to cover the equipment that she uses, and the materials for one table cost her $180. She sells each table for $200.

(a) The cost (C) associated with the number of coffee tables made (n) and the income from selling the coffee tables (I) can be modelled by two equations. **2**

Write the TWO equations using the variables C, n and I.

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(b) On the grid below, draw the graphs of both equations from part (a). **2**

number of coffee tables
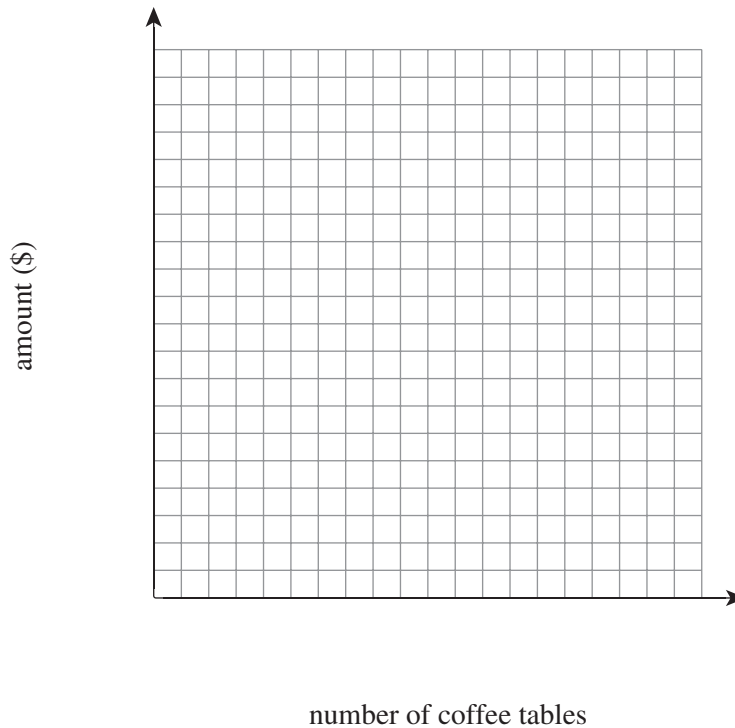
(c) State the coordinates of the point of intersection of the two lines drawn in part (b). Briefly explain the significance of this point of intersection. **2**

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(d) Calculate how much profit Domenica will earn when she makes 30 coffee tables. **2**

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Question 32 (6 marks)

The table shows the future values of an annuity of $1 for different interest rates. Contributions are made at the end of each year.

Future value of an annuity of $1

End of year	Interest rate per annum			
	2%	4%	6%	8%
1	1.00	1.00	1.00	1.00
2	2.02	2.04	2.06	2.08
3	3.06	3.12	3.18	3.24
4	4.08	4.16	4.24	4.32

(a) Hayao opens an annuity account and contributes $16 500 every year. The interest rate is 6% per annum, compounded annually.   **1**

What is the future value of Hayao's annuity after three years?

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(b) Lina opens an annuity account and contributes $13 400 every three months. The interest rate is 16% per annum, compounded quarterly.   **1**

What is the future value of Lina's annuity after one year?

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(c) Mario wants to save $55 000 in two years' time by investing in an annuity. The annuity has an interest rate of 8% per annum, compounded annually.   **2**

Calculate how much Mario needs to contribute each year to achieve his savings goal, correct to the nearest dollar.

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(d) Elliot wants to save $32 475 in one years' time by investing in an annuity. The annuity has an interest rate of 12% per annum, compounded biannually.   **2**

Calculate how much Elliot needs to contribute every six months to achieve their savings goal, correct to the nearest dollar.

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Question 33 (2 marks)

An energy company charges for gas usage over a three-month period according to the table.

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	Usage charge
First 3000 MJ	0.08920 cents per MJ
Additional MJ over 3000	0.08330 cents per MJ

Hannah is trying to budget her household bills. She has a maximum of $150 set aside for her gas bill.

What is the maximum amount of gas, in megajoules, that Hannah can use in the three-month period? Give your answer correct to the nearest whole number.

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Question 34 (3 marks)

Angela is organising a fundraising event to raise money for a charity. She spends $425 to hire a function hall for the evening and charges an entry fee of $55 per guest. Any money that is raised beyond the initial cost of the hall will be donated to the charity and is given by the formula

$$A = 55p - 425,$$

where A is the amount of money raised for donation and p is the number of guests that attend the event.

(a)   Calculate how much money will be raised for donation if 100 guests attend the event.

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(b)   How many guests will need to attend the event to raise $10 000 for donation?

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Question 35 (7 marks)

Frank wants to buy a new car and is considering taking out a loan of $70 000 from his current bank.
The table is used to calculate the monthly repayments for a loan and is based on reducible rate loans.

Monthly repayment per $1000 of loan

Interest rate	Loan term length			
	2 years	*3 years*	*4 years*	*5 years*
1%	$44.10	$31.21	$25.26	$22.09
2%	$44.54	$31.64	$25.70	$22.53
3%	$44.98	$32.08	$26.13	$22.97
4%	$45.42	$32.52	$26.58	$23.42
5%	$45.87	$32.97	$27.03	$23.87
6%	$46.32	$33.42	$27.49	$24.33
7%	$46.77	$33.88	$27.95	$24.80

Frank is comparing two options. Option 1 is to pay the loan back over five years at an interest rate
of 3% per annum. Option 2 is to pay the loan back over three years at an interest rate of 4% per annum.

(a)   How much would Frank pay per month if he chooses option 2?   **1**

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(b)   How much would Frank save per month if he chooses option 1 instead of option 2?   **2**

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(c)   (i)   How much interest would Frank pay over the term of the loan if he chooses option 2?   **2**

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Question 35 continues on page 24

Question 35 (continued)

(ii) Another bank offers Frank a flat-rate loan with the same total repayments over the same term as option 2. **2**

What is the interest rate for this term? Express the interest rate as an annual percentage rate, correct to one decimal place.

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End of Question 35

Question 36 (5 marks)

A set of bivariate data is collected by measuring the lengths and widths of a population of slugs.
A scatterplot of this data is shown.
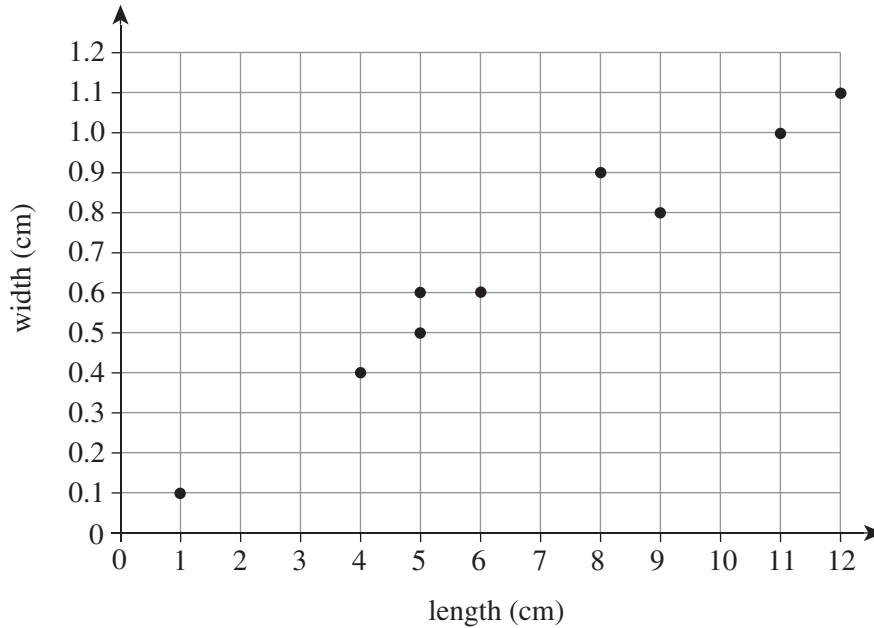
(a)   Calculate Pearson's correlation coefficient for the data, correct to two decimal places.   **1**

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(b)   Identify the direction and strength of the linear relationship between the lengths and widths   **2**
        of the slugs.

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

                     width $= 0.072 + 0.088 \times$ length

        One slug has a width of 0.3 cm.

        Calculate the predicted length of this slug using the least-squares regression line. Give your
        answer correct to one decimal place.

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Question 37 (3 marks)

Scarlett uses a credit card that has an interest rate of 14.8% per annum, compounded daily. The card does not have an interest-free period. Interest is calculated to include the day of transaction and the day on which the account balance is paid.

During December, Scarlett makes the following transactions.

Credit card statement

Date	Transaction	Amount
12 December	clothing store	$84.00
19 December	shoe store	$150.00
21 December	supermarket	$170.00

(a) Calculate the daily interest rate, correct to four decimal places. **1**

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(b) Scarlett intends to pay her account balance in full, including interest, on 5 January. **2**

How much will Scarlett pay in total?

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Question 38 (5 marks)

A town's water supply flows from a dam through a network of underground pipes to individual houses. The network diagram of the pipes shows the amount of water, in kilolitres, that can flow through the pipes to individual houses at any given time.
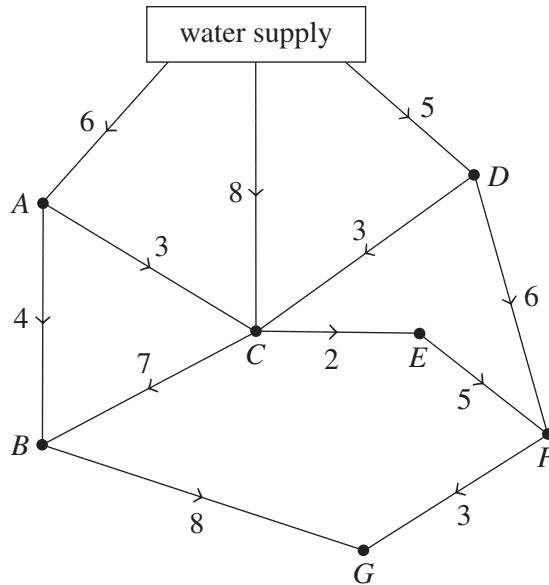
(a) How many different paths of connected pipes in the network allow water to flow from the water supply to house *G*? Include a list of the paths in your answer. **2**

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(b) Determine the maximum flow from the water supply to house *G*. **2**

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(c) Draw the minimum cut on the network diagram above. **1**

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REFERENCE SHEET

Measurement

Limits of accuracy

$$\text{absolute error} = \frac{1}{2} \times \text{precision}$$

upper bound = measurement + absolute error

lower bound = measurement − absolute error

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a+b)$$

$$A \approx \frac{h}{2}(d_f + d_l)$$

Surface area

$$A = 2\pi r^2 + 2\pi r h$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \cos A = \frac{\text{adj}}{\text{hyp}}, \tan A = \frac{\text{opp}}{\text{adj}}$$

$$A = \frac{1}{2}ab\sin C$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Financial Mathematics

$$FV = PV(1+r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0(1-r)^n$$

Statistical Analysis

An outlier is a score

less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

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

Normal distribution
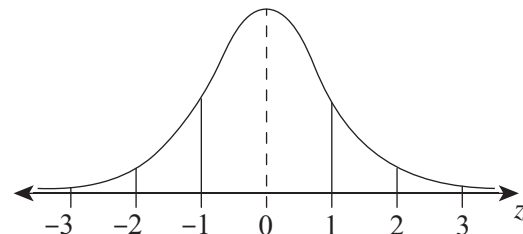
- approximately 68% of scores have z-scores between −1 and 1
- approximately 95% of scores have z-scores between −2 and 2
- approximately 99.7% of scores have z-scores between −3 and 3

SECTION I
MULTIPLE-CHOICE ANSWER SHEET

DIRECTIONS:

Write your name in the space provided.

Write your student number in the boxes provided below. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.

Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark only **one** oval per question.

A ⬭   B ⬤   C ⬭   D ⬭

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ⬤   B ⨂   C ⬭   D ⬭

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as follows.

correct

A ⨂   B ⨂   C ⬭   D ⬭

STUDENT NAME: _____

STUDENT NUMBER:

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

STUDENTS SHOULD NOW CONTINUE
WITH SECTION II