



Trial Examination 2023

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 7–31)

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

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2023 HSC Year 12 Mathematics Standard 2 examination.

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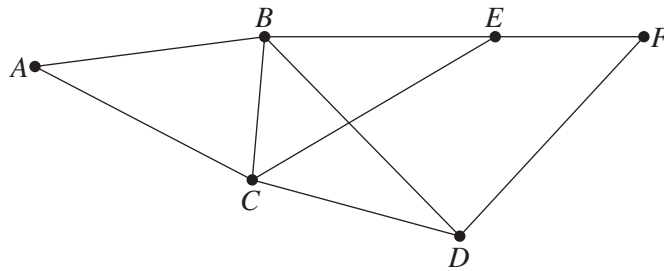
SECTION I**15 marks****Attempt Questions 1–15****Allow about 25 minutes for this section**

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

- 1 One millionth of a second is one microsecond.
What is 6 microseconds written in standard form?

- A. 1×10^{-6} s
- B. 6×10^{-6} s
- C. 6×10^{-3} s
- D. 6×10^6 s

- 2 Consider the network diagram.



Which of the following is NOT a path?

- A. *ABCDF*
 - B. *ACBEF*
 - C. *ACBEC*
 - D. *ABECD*
- 3 Which of the following datasets has a median of 50 and a mean of 60?
- A. 10, 50, 60, 70, 80, 90
 - B. 30, 40, 50, 50, 70, 80
 - C. 40, 40, 45, 55, 70, 90
 - D. 40, 45, 45, 55, 85, 90

- 4 Tony has bought a car for \$17 500. Using the declining-balance method, the car's rate of depreciation is 11%.

What is the value of the car after five years?

- A. \$7727.90
 B. \$9772.10
 C. \$19 716.75
 D. \$29 488.52
- 5 Noel is shopping in the supermarket and is looking at various packets of chips. Which of the following packets of chips has the best value?
- A. 60 g packet of Nofrills chips that costs \$1.25
 B. 135 g packet of Smithy chips that costs \$2.40
 C. 240 g packet of Top chips that costs \$4.10
 D. 300 g packet of Cheap chips that costs \$5.20

- 6 Consider the formula $W = \sqrt[3]{\frac{2\pi}{6Y}}$.

If $Y = 6.83$, what is the value of W ?

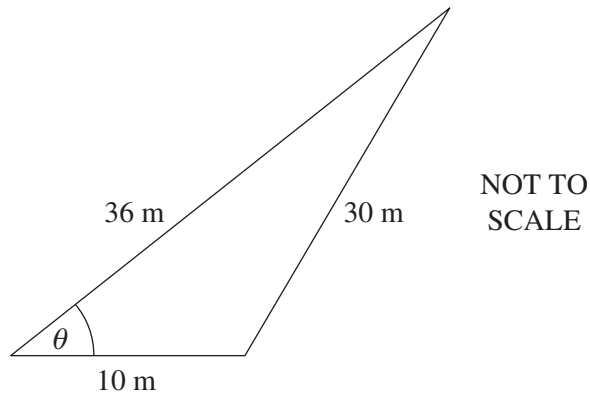
- A. 0.153
 B. 0.535
 C. 1.927
 D. 7.152
- 7 Consider the dot plot.



Which of the following statements is NOT true?

- A. The data is positively skewed.
 B. The data is negatively skewed.
 C. The data has an outlier.
 D. The standard deviation cannot be found.

8 Consider the triangle.

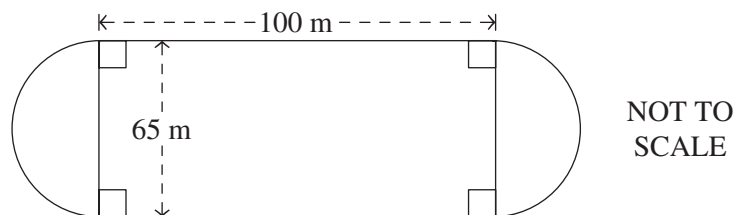


Which of the following is closest to the value of θ ?

- A. 46°
 - B. 52°
 - C. 72°
 - D. 74°
- 9 When driving his car, Adrian travels x km in 2 hours at a speed of y km/h.
Which of the following represents this information?

- A. $y = 2x$
- B. $y = x^2$
- C. $y = \frac{x}{2}$
- D. $y = \frac{2}{x}$

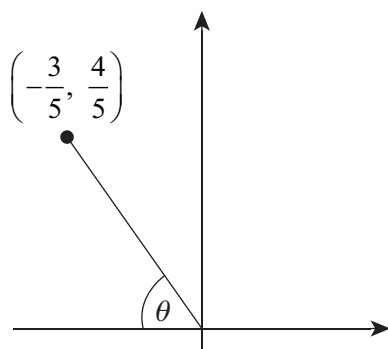
10 The diagram shows a running track with semicircular ends.



What is the distance around the running track?

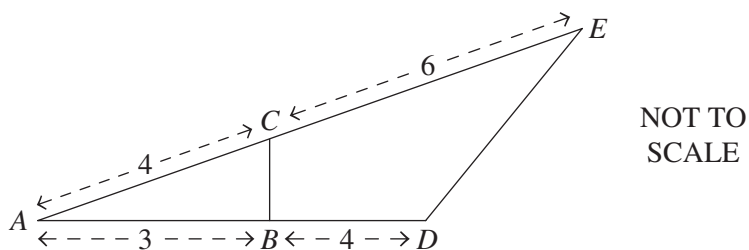
- A. $\left(\frac{65}{2}\right)\pi + 200$ m
- B. $65\pi + 200$ m
- C. $\left(\frac{65}{2}\right)\pi + 330$ m
- D. $65\pi + 330$ m

- 11 Consider the diagram.



What is the value of $\sin \theta$?

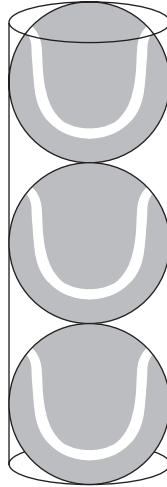
- A. $-\frac{4}{5}$
 B. $-\frac{3}{5}$
 C. $\frac{3}{5}$
 D. $\frac{4}{5}$
- 12 Jihoon is making jam. The recipe he is using requires 10 kg of fruit for every 8 kg of sugar used. If Jihoon has 6 kg of sugar, what mass of fruit does he require?
- A. 7.5 kg
 B. 8.0 kg
 C. 16 kg
 D. 18 kg
- 13 Consider the diagram.



What is the ratio of the area of triangle ABC to the area of triangle ADE ?

- A. 3 : 4
 B. 4 : 6
 C. 6 : 35
 D. 7 : 10

- 14 The diagram shows a cylindrical can containing three spherical tennis balls. All three tennis balls are contained such that they each touch the internal surfaces of the cylinder and each other. The radius of each tennis ball is r .



What fraction of the volume of the cylinder is occupied by the tennis balls?

- A. $\frac{1}{6}$
 B. $\frac{1}{3}$
 C. $\frac{2}{3}$
 D. $\frac{5}{6}$
- 15 The dataset shows the number of shoes sold by a sports shoe shop in one week.

<i>Size of shoes</i>	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12
<i>Number of shoes sold</i>	8	10	13	6	5	4	2	2	1	1	0

The owner of the store wants to know which size is sold most often.

Which of the following measures will be most useful to the owner?

- A. mean
 B. median
 C. mode
 D. range

HSC Year 12 Mathematics Standard 2

Section II Answer Booklet

85 marks

Attempt Questions 16–40

Allow about 2 hours and 5 minutes for this section

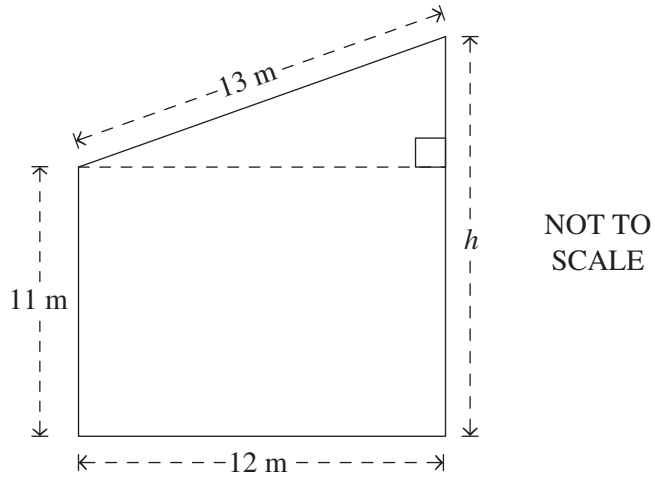
Instructions

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

Question 16 (3 marks)

Consider the composite figure that is made of a right-angled triangle and a rectangle.



- (a) Calculate the value of h . **1**

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- (b) Calculate the area of the composite figure. **2**

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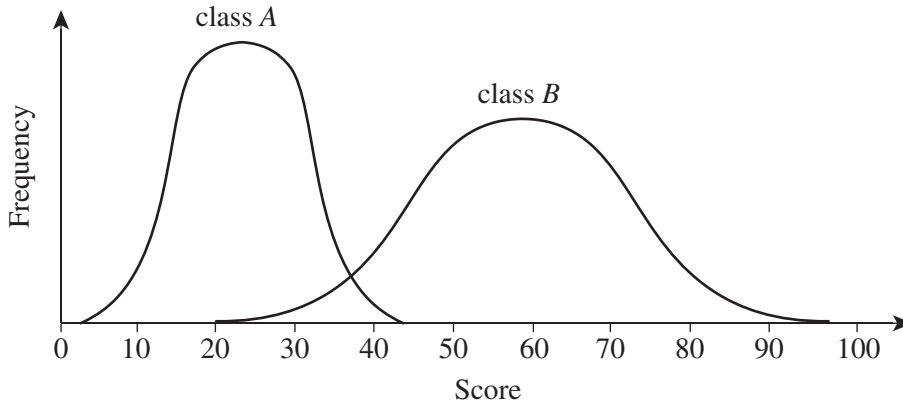
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Question 17 (2 marks)

Classes *A* and *B* completed the same Mathematics examination. The graph shows the results of each class.

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Compare the mean and the standard deviation of each class.

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Question 18 (2 marks)

The time taken for a journey varies with a car's average speed. Two cars were driven the same distance at different speeds. Car *A* was driven at an average speed of 90 km/h and took 5 hours to complete its journey. Car *B* was driven at an average speed of 80 km/h.

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How long did car *B*'s journey take? Give your answer correct to the nearest minute.

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Question 19 (2 marks)

Angelo bought a laptop four years ago. It depreciated by \$220 each year using the straight-line method of depreciation. The salvage value of the laptop is now \$180.

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Calculate the original amount that Angelo paid for the laptop.

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Question 20 (3 marks)

During the 2000 Olympic Games in Sydney, which is located at (35°S, 150°E), the 100 m freestyle swimming final was held on a Wednesday at 2:00 pm local time. The event was broadcast live to New York, which is located at (40°N, 75°W).

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What time and day was the event broadcast in New York? It is given that $15^\circ = 1$ hour time difference. Ignore daylight saving.

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Question 21 (5 marks)

Kai is playing a game of heads or tails with a coin. He tosses the coin three times.

- (a) Draw a tree diagram that shows all the possible outcomes and probabilities for Kai's game. **2**

- (b) What is the probability that Kai will toss exactly one tail? **2**

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- (c) What is the probability that Kai will toss all heads? **1**

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Question 22 (5 marks)

The table shows the individual income tax rates in Australia for the 2022–23 financial year.

<i>Taxable income</i>	<i>Tax on this income</i>
\$0–\$18 200	Nil
\$18 201–\$45 000	19 cents for each \$1 over \$18 200
\$45 001–\$120 000	\$5902 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

Cameron is a teacher and his gross annual income is \$108 000. He paid a total of \$26 200 in Pay As You Go (PAYG) tax during the 2022–23 financial year. His tax deductions include the purchase of teaching resources valued at \$342 and teacher union fees of \$674. Cameron must also pay a Medicare levy of 2% of his taxable income.

- (a) Calculate Cameron’s taxable income and Medicare levy. Give your answers correct to the nearest dollar. **2**

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- (b) Calculate Cameron’s tax payable, including the Medicare levy. Give your answer correct to the nearest dollar. **2**

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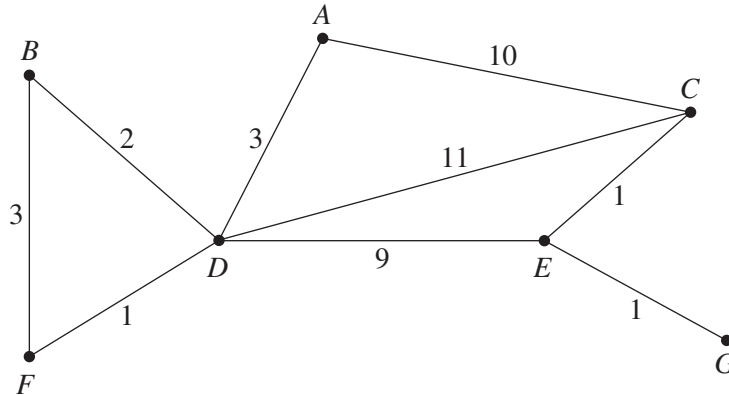
- (c) Given that Cameron paid \$26 200 in PAYG tax, determine whether he will receive a tax refund or owe money to the Australian Taxation Office. **1**

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Question 23 (4 marks)

The network shows the flights offered by an airline between cities *A*, *B*, *C*, *D*, *E*, *F* and *G* each day. The time of each flight is shown in hours.



- (a) Which city is most frequently used by the airline? Justify your answer. 2

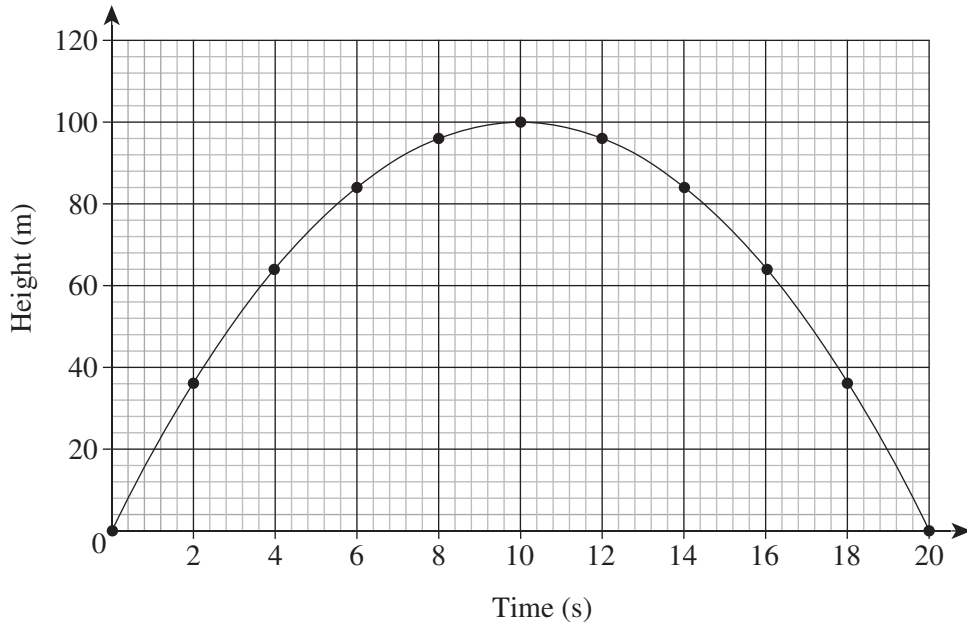
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- (b) A customer wishes to travel from city *B* to city *C* in the shortest amount of time possible. 2
 Draw the path that the customer should take and determine their total travel time.

Total travel time:

Question 24 (4 marks)

The path of a ball after it is projected upwards is described by the curve $h = 20t - t^2$, where h is the height, in metres, and t is the time, in seconds, as shown in the graph.



- (a) Find the vertical distance that the ball travels in the third second. 2

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- (b) Find the ball's average speed in the third second. 2

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Question 25 (2 marks)

A loaf of bread is measured to have a mass of 700 g, to the nearest 10 g.

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Calculate the percentage error of this measurement, correct to three decimal places.

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Question 26 (4 marks)

Charlotte invested \$7000 for six years at an interest rate of 4.5% per annum.

- (a) Find the amount of compound interest that Charlotte earned after six years, correct to the nearest cent.

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- (b) If the compound interest found in part (a) was earned as simple interest over the same period, determine the simple interest rate used. Give your answer correct to two decimal places.

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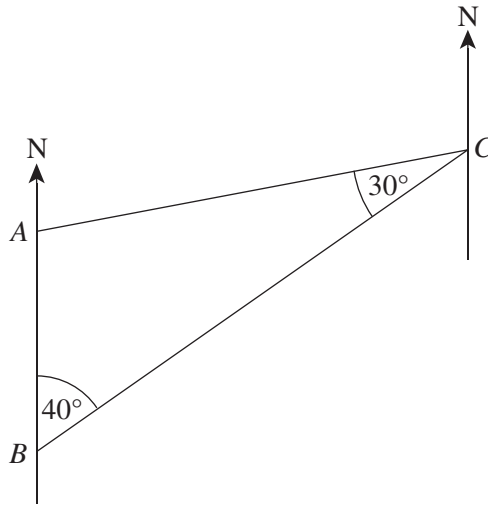
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Question 27 (4 marks)

The diagram shows the walking paths between three viewing points, A , B and C . Angle ABC is 40° and angle ACB is 30° .



- (a) Find the bearing of point A from point C . 2

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- (b) Given that the length of path AC is 12 km, find the length of path AB . Give your answer correct to the nearest kilometre. 2

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Question 28 (3 marks)

Carina is looking to buy a new car. She has recorded the engine size and fuel economy of the different cars she is interested in, as shown in the table.

<i>Car</i>	<i>Engine size (L)</i>	<i>Fuel economy (L/100 km)</i>
<i>A</i>	1.6	6.4
<i>B</i>	1.8	5.9
<i>C</i>	1.6	6.8
<i>D</i>	1.4	6.1
<i>E</i>	2.2	8.5

- (a) Calculate the Pearson’s correlation coefficient (r) for the relationship between engine size and fuel economy. Give your answer correct to four decimal places. **1**

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- (b) With reference to the Pearson’s correlation coefficient calculated in part (a), describe the correlation of the relationship between engine size and fuel economy. **1**

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- (c) Based on the data from the table, what can be concluded about the relationship between engine size and fuel economy? **1**

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Question 29 (3 marks)

Solve $\frac{3x}{2} - \frac{x}{4} = 5 + x$ for x .

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Question 30 (2 marks)

Paula purchased 1000 shares in a vitamin company. Paula initially paid \$8500 for the shares. She recently received a dividend of \$0.76 per share.

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Calculate the dividend yield, correct to two decimal places.

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Question 31 (3 marks)

The present value interest factors for a reducing balance loan are shown in the table.

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Present value interest factors

$N \backslash r$	<i>Interest rate per period as a decimal</i>					
	0.0090	0.0095	0.0100	0.0105	0.0110	0.0115
5	4.8677	4.7350	4.6022	4.4699	4.3386	4.2086
10	9.5223	9.0632	8.6235	8.2036	7.8034	7.4228
15	13.9729	13.0275	12.1577	11.3579	10.6223	9.9455
20	18.2285	16.6651	15.2804	14.0497	12.9521	11.9700
30	26.1886	23.0886	20.5259	18.3784	16.5578	14.9987
35	29.9091	25.9291	22.7407	20.1361	17.9738	16.1544
40	33.4665	28.5532	24.7319	21.6820	19.1969	17.1377
45	36.8682	30.9812	26.5285	23.0494	20.2617	17.9827
50	40.1208	33.2308	28.1549	24.2654	21.1953	18.7150
55	43.2309	35.3182	29.6317	25.3518	22.0190	19.3547
60	46.2047	37.2575	30.9766	26.3267	22.7498	19.9173

Natalia has reached her credit card’s limit of \$10 000. She wants to pay off this amount monthly over five years.

If the credit card has an interest rate of 12% per annum, calculate Natalia’s monthly repayment. Give your answer correct to two decimal places.

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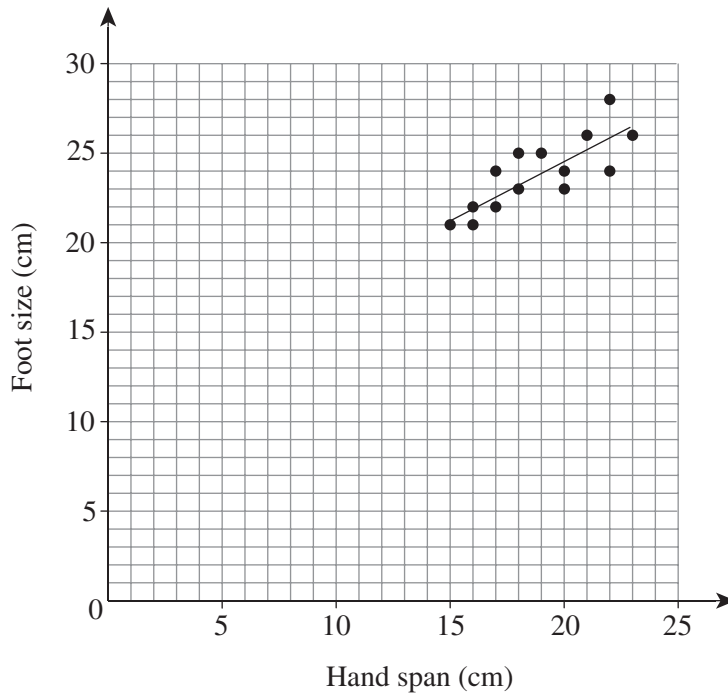
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Question 32 (4 marks)

Kayden measures the hand span and foot size of his classmates. He places his data in a scatterplot.



- (a) Using the scatterplot, identify the direction of the correlation between hand span and foot size. **1**

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- (b) Find the gradient and, hence, the equation of the line of best fit. **2**

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- (c) Using the equation of the line of best fit found in part (b), estimate the foot size of a student who has a hand span of 10 cm. **1**

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Question 33 (6 marks)

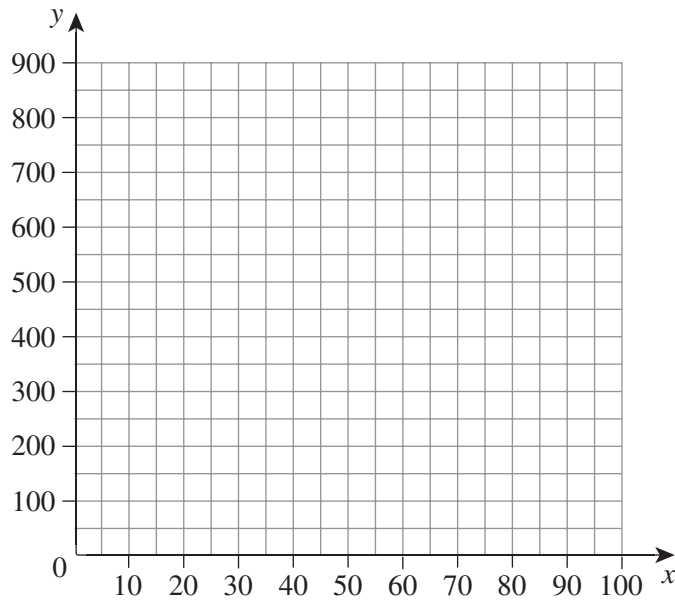
A clothing manufacturer receives \$10 for each pair of shorts it produces. Thus, the manufacturer's profit is given by $y = 10x$, where x is the number of shorts produced and y is the total profit.

- (a) Each week, the clothing manufacturer's production costs include a fixed cost of \$650 plus an additional \$2 per pair of shorts produced for labour and materials. Let x be the number of shorts produced each week and y the production costs per week. 2

Find the equation to represent the cost of production.

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- (b) On the grid below, sketch the graphs of $y = 10x$ and the equation found in part (a). 2



- (c) How many pairs of shorts does the manufacturer need to produce each week to generate a profit? 2

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Question 34 (3 marks)

Steve is a cabinet maker. He uses an 800 W electric drill for 2.5 hours every day. Steve’s electricity plan is paid at a discounted rate of 28.66 cents per kWh. **3**

How much will it cost Steve to use the drill for one year? Give your answer correct to two decimal places.

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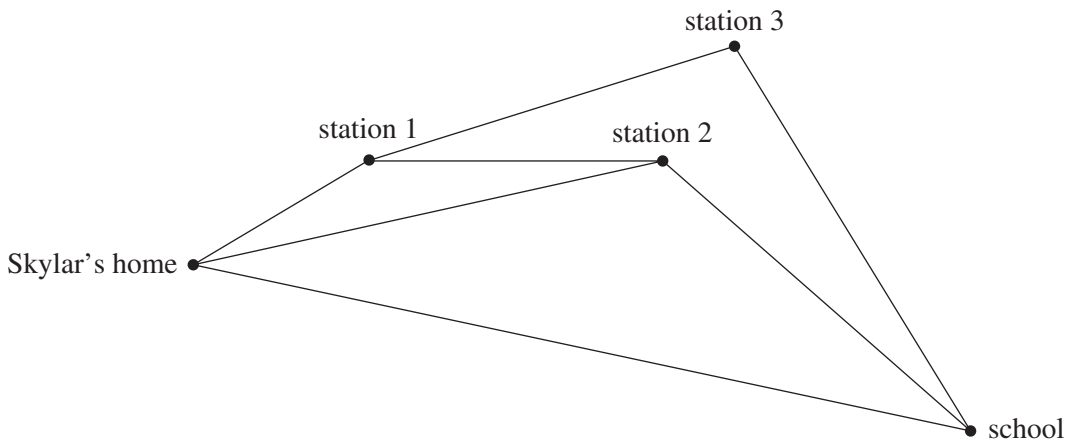
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Question 35 (4 marks)

Each morning, Skylar travels to school from her home. She uses one of two travel methods.

- Method 1: walking only
- Method 2: walking to a train station that is near her home, catching a train to a station that is near her school and then walking to school from the station

There are multiple train stations that Skylar can walk to from her home, and multiple train stations she can walk to school from. To represent her possible journeys, Skylar constructs the network diagram and table shown.



	<i>School</i>	<i>Station 1</i>	<i>Station 2</i>	<i>Station 3</i>
<i>Home</i>	34-minute walk	8-minute walk	20-minute walk	–
<i>Station 1</i>	–	–	7-minute train ride	9-minute train ride
<i>Station 2</i>	14-minute walk	7-minute train ride	–	–
<i>Station 3</i>	16-minute walk	9-minute train ride	–	–

- (a) Skylar decides to travel to school by walking and catching a train. **2**

If she takes the shortest path, how long does it take Skylar to travel to school?

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Question 35 continues on page 24

Question 35 (continued)

(b) Draw the minimum spanning tree of the network in the space below. **1**

(c) On a particular day, Skylar walks to station 1. The next train that goes to station 2 will arrive in five minutes. She checks her map app and sees that it would take her 29 minutes to walk directly from station 1 to school via a new walking path. **1**

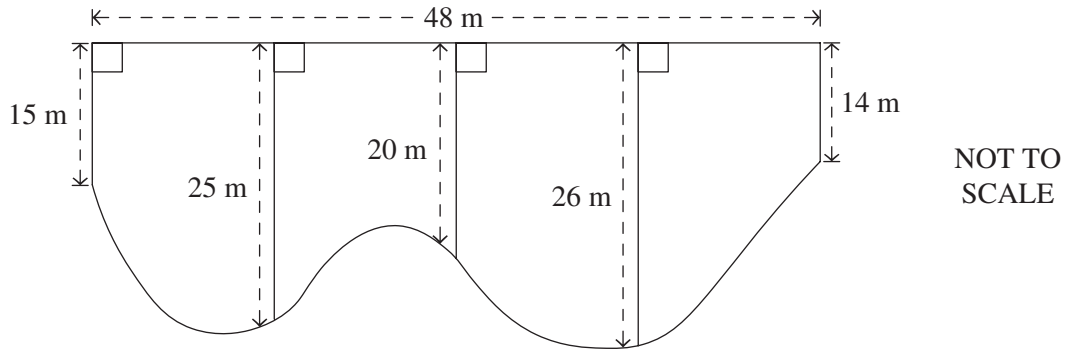
Would it be faster for Skylar to walk directly to school from station 1 or to wait for the train to station 2 and then walk from station 2 to school?

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End of Question 35

Question 36 (5 marks)

The diagram shows the front view of a concrete wall that will be built as part of a dam.



The wall will be built in four sections, each of which will be 12 m wide.

- (a) Using four applications of the trapezoidal rule, estimate the area of the concrete wall. **3**

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- (b) The concrete wall will have a thickness of 28 m. **2**
Calculate the volume of concrete required to build the wall, correct to the nearest cubic metre.

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Question 37 (3 marks)

Kenna received a result of 73% for a Mathematics trial exam. Her class's mean result was 78% and the standard deviation was 4.

3

Kenna wants to obtain a better result in her actual exam, so one day after school, she completes a different trial exam that she borrows from her friend Nina, who attends a different school. Kenna scores 70% in this exam. At Nina's school, the mean result was 84% and the standard deviation was 8. Relative to the other students, in which exam did Kenna achieve a better result?

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Question 38 (2 marks)

The blood alcohol content (BAC) of a male can be calculated using the formula

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

Ivan wants to calculate his BAC before leaving a party. He weighs 110 kg. Ivan arrived at the party at 7:30 pm and consumed five glasses of beer that each contained 1.1 standard drinks. He plans to leave the party at midnight.

Calculate Ivan’s BAC at midnight, correct to four decimal places.

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Question 39 (3 marks)

Ellie is five years old and weighs 18 kg. She is prescribed a medication that specifies a dosage of 100 mg per kg, which is to be taken once a day. The medication is in liquid form and has a concentration of 40 mg per mL.

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Calculate the dosage, in mL, of the medication that should be given to Ellie per day.

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Question 40 (4 marks)

The table shows the future value of an annuity of \$1.

Future values of an annuity of \$1

<i>Period</i>	<i>Interest rate per period</i>					
	1%	2%	3%	4%	5%	6%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938
8	8.2857	8.5830	8.8923	9.2142	9.5491	9.8975
9	9.3685	9.7546	10.1591	10.5828	11.0266	11.4913
10	10.4622	10.9497	11.4639	12.0061	12.5779	13.1808
11	11.5668	12.1687	12.8078	13.4864	14.2068	14.9716
12	12.6825	13.4121	14.1920	15.0258	15.9171	16.8699

Jamari wants to save for a deposit to buy a house in five years. Every six months, she puts \$2000 into a bank account that earns 12% per annum, compounding biannually.

- (a) Find the amount that Jamari will have saved after five years. Give your answer correct to two decimal places.

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Question 40 continues on page 29

Question 40 (continued)

- (b) Jamari and her sister Cara decide that they want to buy a house together. Cara opens a bank account that also earns 12% per annum, but she deposits \$1600 every six months. 2

After how many years will Cara be able to contribute more to the deposit than Jamari?

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REFERENCE SHEET

Measurement**Limits of accuracy**

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

$$\text{upper bound} = \text{measurement} + \text{absolute error}$$

$$\text{lower bound} = \text{measurement} - \text{absolute error}$$

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

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

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

Trigonometry

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

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

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

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

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

Volume

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

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

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

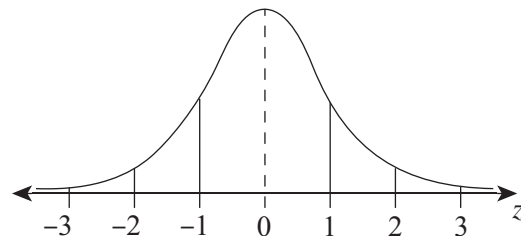
An outlier is a score

$$\text{less than } Q_1 - 1.5 \times IQR$$

or

$$\text{more than } Q_3 + 1.5 \times IQR$$

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

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

Neap Trial Examination 2023

HSC Year 12 Mathematics Standard 2

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.

A B C D
correct
 ↓

STUDENT NAME: _____

STUDENT NUMBER:

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1	<input type="radio"/> 1
<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2	<input type="radio"/> 2
<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3	<input type="radio"/> 3
<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4	<input type="radio"/> 4
<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5	<input type="radio"/> 5
<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6	<input type="radio"/> 6
<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7	<input type="radio"/> 7
<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8	<input type="radio"/> 8
<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9	<input type="radio"/> 9
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SECTION I

MULTIPLE-CHOICE ANSWER SHEET

- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D
- A B C D

**STUDENTS SHOULD NOW CONTINUE
WITH SECTION II**