

Final Examination 2021

NSW Year 11 Mathematics Standard

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours
- 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: 80

Section I – 15 marks (pages 2–6)

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

Section II – 65 marks (pages 7–32)

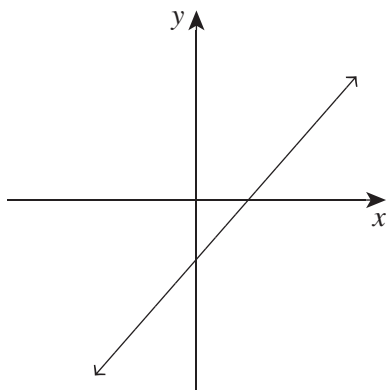
- Attempt Questions 16–33
- Allow about 1 hour and 35 minutes for this section

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.

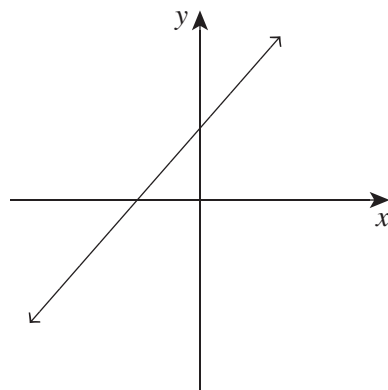
- 1 A container holds 10 discs. Four discs are red, two are yellow and the remainder are blue. What is the probability of selecting a blue disc from the container?
- A. $\frac{1}{10}$
- B. $\frac{2}{10}$
- C. $\frac{2}{5}$
- D. $\frac{3}{5}$
- 2 Rian pays \$30 including goods and services tax (GST) for a haircut. What amount of GST does Rian pay?
- A. \$2.73
- B. \$3.00
- C. \$3.30
- D. \$27.00
- 3 Jo purchased a car for \$75 000. The value of the car depreciates \$5000 per year. The current salvage value of the car is \$60 000. When did Jo purchase the car?
- A. two years ago
- B. three years ago
- C. four years ago
- D. five years ago
- 4 The coordinates of the city of New York are approximately (40°N, 75°W). The coordinates of Nicosia are approximately (35°N, 30°E). What is the local time in Nicosia if it is 7:00 am in New York?
- A. 10:00 am
- B. 12:00 pm
- C. 2:00 pm
- D. 10:00 pm

5 Which of the following could represent the graph of $y = 3x + 2$?

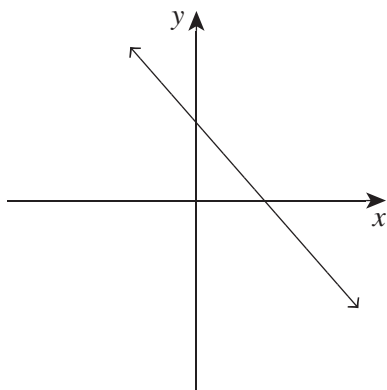
A.



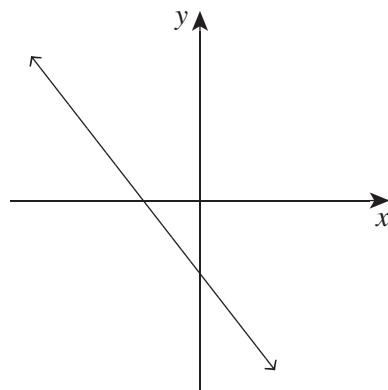
B.



C.



D.



6 Which of the following symbols represents population mean?

- A. s
- B. σ
- C. μ
- D. \bar{x}

7 Andrea, aged 38, starts having cold and flu symptoms. Her doctor recommends that she take a cold and flu medicine. Andrea consumes the adult dosage three times a day over a 24-hour period as recommended. During that period, she consumes 75 mL of medicine. The dosage for children aged 1–2 years old is given by Fried's formula

$$\text{dosage for children 1–2 years} = \frac{\text{age of child (in months)} \times \text{adult dosage}}{150}.$$

What is the recommended dosage of the cold and flu medicine for a child who is one-and-a-half years old?

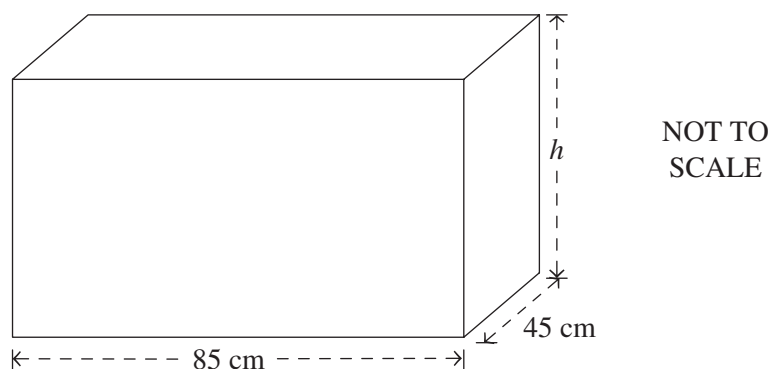
- A. 0.25 mL
- B. 0.75 mL
- C. 3.00 mL
- D. 9.00 mL

- 8 Yvonne filled the petrol tank in her car with 48 litres of petrol. The following diagram shows the information displayed on the petrol bowser.

\$	76.75
Litres	48
Cents per litre	
Unleaded 98	170.9
Unleaded 95	164.9
Unleaded E10	157.9
Diesel	159.9

- Yvonne paid \$76.75 for the petrol.
What type of petrol did Yvonne purchase?
- A. Unleaded 98
B. Unleaded 95
C. Unleaded E10
D. Diesel
- 9 Hugh and Louis work as sales representatives for the same company. Hugh earns \$300 per week plus 3.5% commission on sales. Louis earns 5% commission on sales only.
What value of sales would Hugh and Louis each need to achieve to earn the same amount?
- A. \$5000
B. \$10000
C. \$20000
D. \$30000
- 10 Thomas invests \$9000 in a bank account that earns 0.5% simple interest per month.
Which of the following expressions represents the amount of interest that Thomas' account will have earned after four years?
- A. $I = 9000 \times 0.005 \times 4$
B. $I = 9000 \times 0.05 \times 48$
C. $I = 9000 \times 0.05 \times 4$
D. $I = 9000 \times 0.005 \times 48$

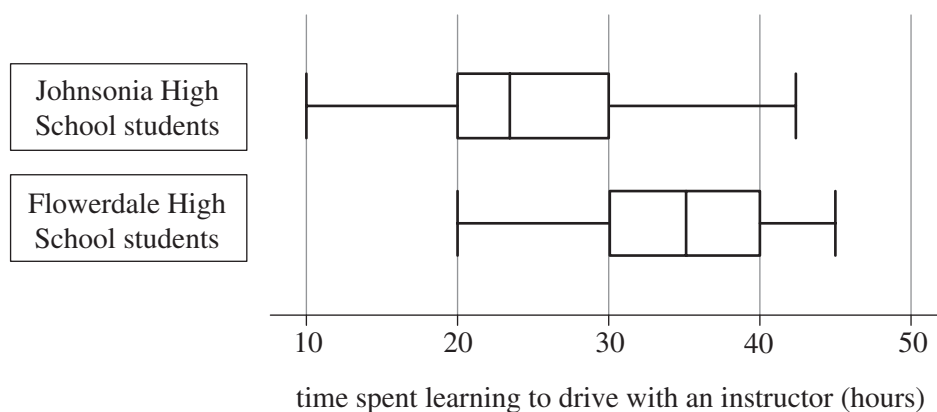
- 11 The diagram shows the dimensions of a rectangular prism.



The prism has a capacity of 76.5 litres.

What is the height (h) of the prism?

- A. 0.02 cm
 B. 2 cm
 C. 20 cm
 D. 200 cm
- 12 The box-plots represent the number of hours that:
- 200 students from Johnsonia High School spent learning to drive with their driving instructors
 - a certain number of students from Flowerdale High School spent learning to drive with their driving instructors.

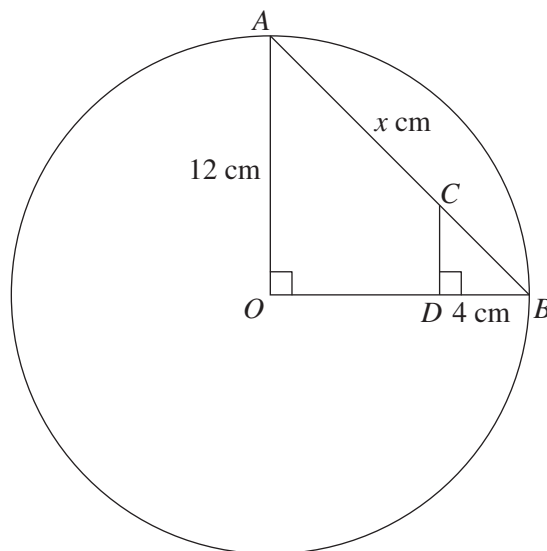


The same number of students from both schools spent 20–30 hours learning to drive.

How many students do the box-plots represent in total?

- A. 600
 B. 800
 C. 1000
 D. 1200

- 13** The length of a bridge was measured to be 212.4 metres, correct to the nearest 10 cm. What is the percentage error of this measurement, correct to two significant figures?
- A. 0.024%
 B. 0.047%
 C. 2.4%
 D. 4.7%
- 14** Theo rolls a standard die and selects a marble from a bag that contains four equal-sized marbles. Each marble is labelled with a number: 1, 2, 3 or 4. What is the probability that at least the die or the marble shows the number 1?
- A. $\frac{1}{12}$
 B. $\frac{1}{5}$
 C. $\frac{3}{8}$
 D. $\frac{5}{12}$
- 15** The circle with centre O contains two triangles: triangle AOB and triangle CDB . The triangles are similar.



NOT TO SCALE

AC is x cm in length.

What is the value of x , correct to the nearest whole number?

- A. 4 cm
 B. 11 cm
 C. 12 cm
 D. 16 cm

NSW Year 11 Mathematics Standard

Section II Answer Booklet 1

Section II

65 marks

Attempt Questions 16–33

Allow about 1 hour and 35 minutes for this section

Booklet 1 – Attempt Questions 16–24 (33 marks)

Booklet 2 – Attempt Questions 25–33 (32 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 17–18 of Booklet 1. If you use this space, clearly indicate which question you are answering.
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Please turn over

Question 16 (2 marks)

Erin is a doctor and earns \$4600 per week.

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Erin will be taking four weeks' annual leave. During this time, she will receive 17.5% annual leave loading on four weeks' pay in addition to her regular pay.

Calculate Erin's total pay during her four weeks' annual leave.

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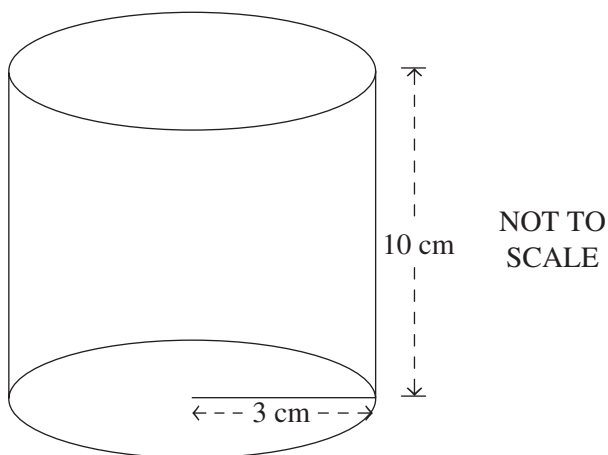
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Question 17 (4 marks)

A ceramics company produces cylindrical drinking glasses. Each glass has a height of 10 cm and a circular base with a radius of 3 cm.



- (a) What is the external surface area of one glass, correct to two decimal places? 2

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- (b) The glasses are sold in boxes of twelve. Each box is a rectangular prism. The glasses are stacked in two layers inside a box, and each layer has two rows of three glasses. Calculate the external surface area of one box when it is closed. 2

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Question 18 (5 marks)

Henry bought a bag of red and green lollies. The bag contained 35 red lollies and 15 green lollies.

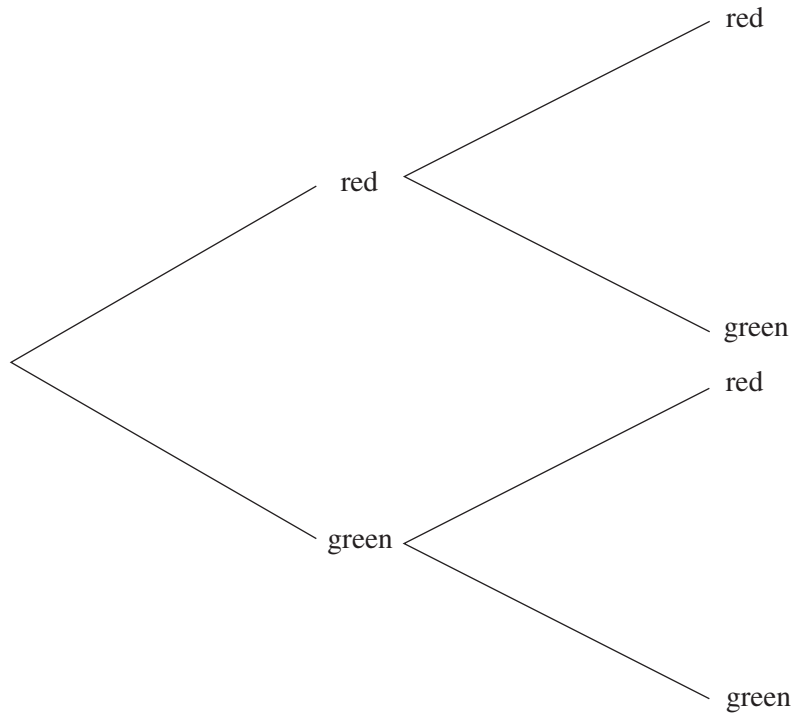
- (a) What is the relative frequency of Henry selecting a green lolly from the bag? **1**

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- (b) Henry wishes to determine the probabilities if two lollies were selected from the bag at random. **2**

Complete the probability tree diagram below by labelling the probabilities on each branch.



- (c) Henry selects two lollies from the bag at random. **2**
 Calculate the probability that at least one of the lollies that Henry selects is green.

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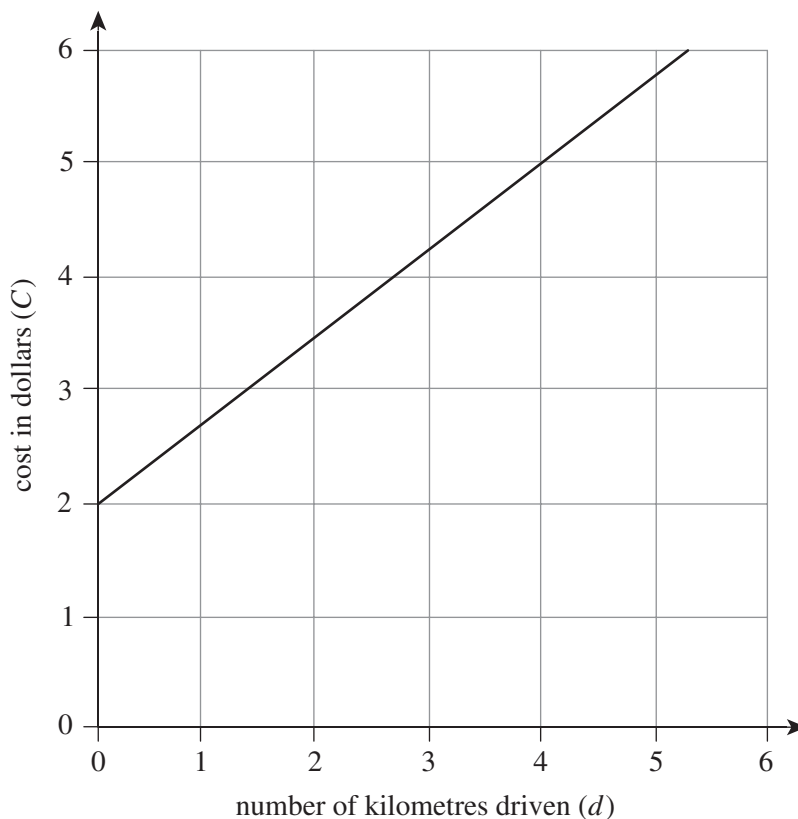
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Question 19 (4 marks)

When booking a car from a rideshare company, customers are charged a booking fee and a rate for each kilometre they travel in the car. The graph shows the cost of using the rideshare service.



- (a) Calculate the gradient of the line and explain what it indicates in this context. 2

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- (b) What is the equation of this linear model? 1

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- (c) A customer is charged \$18.20 for using the rideshare service. 1
How many kilometres did the customer travel in the rideshare car?

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Question 20 (6 marks)

For the 2020–2021 financial year, Zachary earns a gross income of \$127 550 per annum. He also earns \$15 500 per annum in rental income from his investment property.

Zachary’s allowable tax deductions total \$7250, and he contributes \$39 000 per annum in Pay As You Go (PAYG) tax.

- (a) What is Zachary’s taxable income? 1

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- (b) The table shows the income tax rates for the 2020–2021 financial year. 2

<i>Taxable income</i>	<i>Tax on this income</i>
0–\$6000	Nil
\$6001–\$37 000	15c for each \$1 over \$6000
\$37 001–\$80 000	\$4650 plus 30c for each \$1 over \$37 000
\$80 001–\$180 000	\$17 550 plus 37c for each \$1 over \$80 000
\$180 001 and over	\$54 550 plus 45c for each \$1 over \$180 000

Calculate Zachary’s income tax payable.

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- (c) Zachary is required to pay 1.5% of his taxable income towards the Medicare levy. 1
How much must Zachary pay towards the Medicare levy?

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- (d) Using appropriate calculations, determine whether Zachary has a tax debt or a tax refund. 2

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Question 21 (3 marks)

The teachers at Smithland High School can travel to work via a freeway, which has a toll. The frequency distribution table shows the number of times the teachers drive through the toll booth each day.

<i>Number of times a teacher drives through the toll booth each day</i>	<i>Frequency</i>
0	12
1	3
2	22
3	5
4	2

- (a) Determine the mode of this dataset and explain what it indicates in this context. **2**

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- (b) A driver is charged \$5.75 each time they drive through the toll booth. **1**
 Calculate the total amount that the Smithland High School teachers spend on tolls each day.

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Question 22 (2 marks)

Make s the subject of the formula $p = 4r - 2s^2$.

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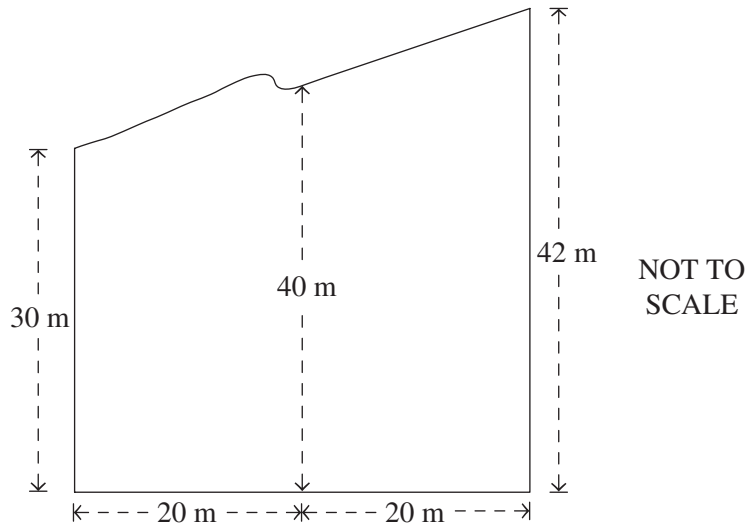
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Question 23 (4 marks)

Vikram owns a farm that has a grass field with an irregular boundary. The diagram shows the measurements of the field.



- (a) Using **two** applications of the trapezoidal rule, calculate the approximate area of the field. 2

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- (b) Land tax is charged at a rate of \$5 per 15 m² or part thereof. 2

Using your value from part (a), calculate the amount of land tax that Vikram is required to pay for the field.

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Question 24 (3 marks)

Phoenix arrived at his friend’s house at 7:00 pm on Saturday and consumed five standard drinks. He stopped drinking at 11:00 pm. Phoenix’s blood alcohol content (BAC) was 0 at 1:40 am on Sunday. The following formula is used to calculate an estimate for BAC for males.

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

The number of hours required for a person to reach a BAC of 0 after they stop consuming alcohol is given by the following formula.

$$\text{time} = \frac{BAC}{0.015}$$

Calculate Phoenix’s weight, correct to two decimal places.

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NSW Year 11 Mathematics Standard

Section II Answer Booklet 2

Booklet 2 – Attempt Questions 25–33 (32 marks)

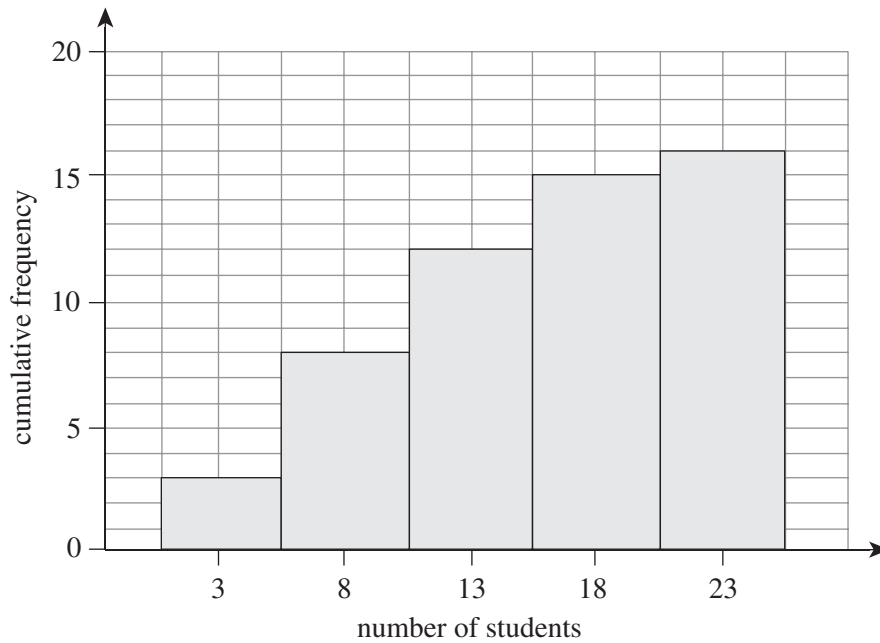
Instructions

- 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 30–32 of Booklet 2. If you use this space, clearly indicate which question you are answering.
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Please turn over

Question 25 (4 marks)

The cumulative frequency histogram shows the number of times a group of students went to Water Fun Park in January.



- (a) Explain why it is not possible to calculate the range using the dataset above. 1

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- (b) Complete the frequency distribution table below. 2

<i>Number of students</i>	<i>Frequency</i>	<i>Cumulative frequency</i>
3	3	3
8	5	8
13	4	12
18		15
23		

- (c) Estimate the mean. 1

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Question 26 (2 marks)

One grain of rice has a mass of 1.7×10^{-3} grams.

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How many grains of rice are required to make 1 kg of rice? Give your answer in standard form, correct to two significant figures.

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Question 27 (4 marks)

Daya owns a fencing company. The cost (c) in dollars to build a fence varies directly with the length (l) of the fence in metres. It costs \$1905.50 to build a fence that is 37 metres in length.

- (a) Write an equation relating the variables c and l , and the constant of variation (k). **1**

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- (b) Calculate the value of k and determine the length of a fence that costs \$1184.50 to build. **2**

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- (c) The company introduces a booking fee of \$100, which is added to the total cost of building a fence. **1**

Do the total cost of building a fence (including the booking fee) and the length of the fence vary directly? Justify your answer.

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Question 28 (2 marks)

A peeled grapefruit, which is in the shape of a sphere, is cut into eight identical pieces. Each piece has a capacity of 12 mL.

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Calculate the radius of the grapefruit, correct to the nearest centimetre.

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Question 29 (5 marks)

The number of songs that 10 students listened to in one day are shown.

9 12 14 15 15 17 20 22 23 25

- (a) Complete a five-number summary for the dataset above. **3**

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- (b) Are any of the numbers from the dataset considered outliers? Justify your answer with calculations. **2**

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Question 30 (3 marks)

The Coordinated Universal Time (UTC) of Sydney is +10 hours. Roberto flew from City A to Sydney. It took Roberto 23 hours and 15 minutes to travel from City A to Sydney.

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If Roberto left City A at 9:20 pm on Wednesday and arrived in Sydney at 1:35 pm on Friday, what is the UTC of City A? Give your answer correct to the nearest whole number.

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Question 31 (4 marks)

Karla ate one serving of chips for lunch. The amount of energy in one serving of chips is shown in the table.

	<i>One serving contains</i>	<i>Percentage of daily adult intake</i>
<i>Energy</i>	1290 kJ	15%

- (a) Karla went to a weight training class at the gym that evening. The gym advertises that during the class, a participant will burn 35 kilojoules per kilogram per hour. **2**

The class goes for 40 minutes, and Karla weighs 53 kilograms.

Determine whether Karla burned off the energy contained in the serving of chips in the class. Justify your answer with calculations.

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- (b) According to the information above, how many kilocalories should the average adult consume each day? Give your answer correct to the nearest whole number. **2**
 (1 kilocalorie = 4.184 kilojoules)

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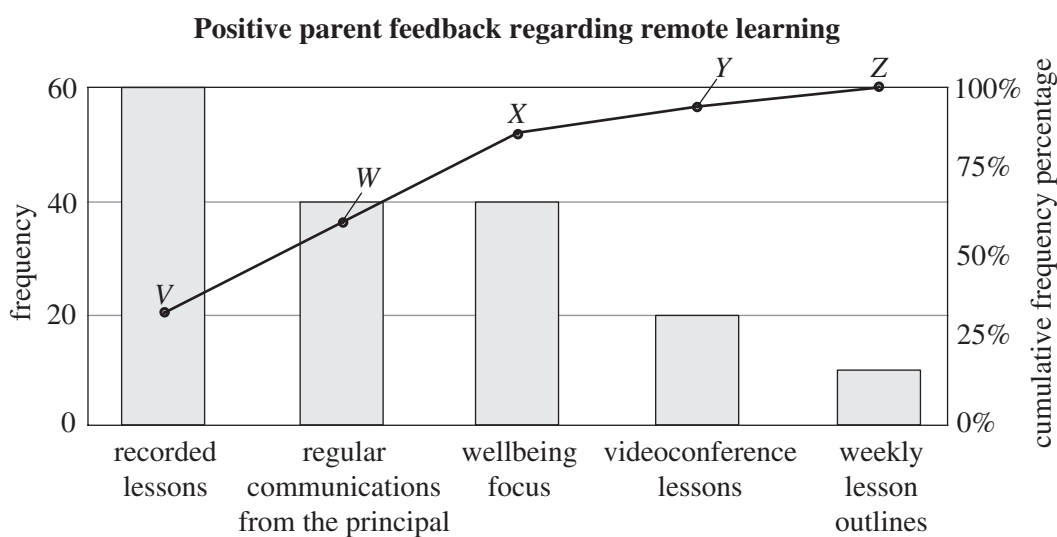
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Question 32 (4 marks)

Parents at Mathville High School were surveyed and asked to indicate what they believed was the school’s best remote learning achievement. The possible responses were:

- recorded lessons where the teacher explained the work
- regular communications from the principal
- wellbeing focus
- videoconference lessons
- weekly lesson outlines.

The school collected the responses and presented this information in the Pareto chart shown below.



- (a) What percentage of respondents said the school’s videoconference lessons were the best achievement? Give your answer correct to two decimal places. **1**

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- (b) What value is represented by point X correct to two decimal places? Support your answer with calculations. **2**

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Question 32 continues on page 28

Question 32 (continued)

- (c) Explain why the line segment from point V to point W has the same slope as the line segment from point W to point X . **1**

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End of Question 32

Question 33 (4 marks)

At the start of January 2021, Kayla invested \$4000 in a bank account that earns an interest rate of 3.6% per annum compounded quarterly.

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The bank offered Kayla a new interest rate per annum in the third quarter. The value of Kayla's investment at the end of the third quarter was \$4113.04.

Determine the new interest rate per annum correct to the nearest percent.

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End of paper

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

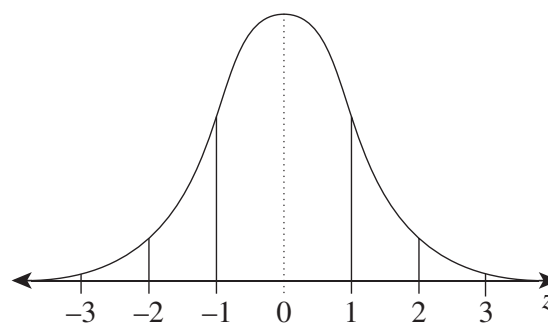
$$\text{less than } Q_1 - 1.5 \times IQR$$

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 Final Examination 2021 NSW Year 11 Mathematics Standard

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:

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①	①	①	①	①	①	①	①	①
②	②	②	②	②	②	②	②	②
③	③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④	④
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⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨
⑩	⑩	⑩	⑩	⑩	⑩	⑩	⑩	⑩

SECTION I MULTIPLE-CHOICE ANSWER SHEET

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**