

Q11-21 MBL

Q22-30 VL

Q31-36 TL

Carlingford High School

2020 Year 11 Final Examination
Mathematics Standard 2

Student Number : _____

Section I – Multiple Choice Answer Sheet

Allow about 25 minutes for this section

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

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 the correct answer by writing the word **correct** and drawing an arrow as follows.

A ☒ B ☒ ^{correct} C ☐ D ☐

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 ☐

Section II (75 marks)

Attempt Questions 11-36.

Write answers in the spaces provided. Allow about 90 minutes for this section.

Marks

Question 11

5

Solve the following equations:

a) $3y + 4 = -14$

$$\begin{aligned} 3y &= -18 \\ y &= -6 \quad (1) \end{aligned}$$

b) $\frac{2a}{3} - 5 = 4$

$$\begin{aligned} \frac{2a}{3} &= 9 \\ 2a &= 27 \quad (1) \\ a &= \frac{27}{2} \text{ or } 13\frac{1}{2} \quad (1) \end{aligned}$$

c) $2(x + 1) = 4(2x - 1)$

$$\begin{aligned} 2x + 2 &= 8x - 4 \quad (1) \\ 6 &= 6x \\ 1 &= x \quad (1) \end{aligned}$$

Question 12

Harry buys a new heater which is rated at 3200 watts. He uses it on 100 days of the year for an average of 8 hours per day.

a) How much electricity, in kW, does the heater use for the year?

2

$$\begin{aligned} &(3200 \div 1000) \times 100 \times 8 \\ &= 2560 \text{ kW} \end{aligned}$$

1 mark for 3.2 kW

b) Electricity costs are \$0.31 per kilowatt-hour. What would the heater cost to run for the year?

1

$$\begin{aligned} &2560 \times 0.31 \\ &= \$793.60 \end{aligned}$$

Question 13

Ginny rolled a standard six-sided die 100 times and recorded the results in a table.

Outcome	Frequency
1	23
2	19
3	11
4	12
5	18
6	17

- a) Find the experimental probability of rolling an even number less than 4.

1

..... $\frac{19}{100}$

- b) If the die is rolled 100 times, what is the expected number of times of obtaining the number 2?

1

..... $\frac{1}{6} \times 100 = 16.\dot{6}$
 ①

Question 14

2

Young's formula below is used to calculate the required dosages of medicine for children aged 1–12 years.

$$\text{Dosage} = \frac{\text{age of child (in years)} \times \text{adult dosage}}{\text{age of child (in years)} + 12}$$

How much of the medicine should be given to an 18-month-old child in a 24-hour period if each adult dose is 45 mL? The medicine is to be taken every 6 hours by both adult and children.

..... $D = \frac{1.5 \times 45}{1.5 + 12}$

 $= 5 \text{ mL}$ ①
 $5 \times 4 = 20 \text{ mL}$ ①

Question 15

2

Bellatrix works in a used car yard, where she spends some time doing clerical work and when needed, she acts as a salesperson. She is paid \$500 a week as a retainer plus a commission of 4% of any sales over \$10 000.

Last week Bellatrix sold a car to the value of \$16 000. What was her total pay for the week?

..... $\text{Commission} = 6000 \times 4\%$
 $= 240$ ①

 $\text{Total} = 240 + 500$
 $= \$740$ ①

Question 16

Ron purchased film-editing equipment for \$5000. After 3 years it has depreciated to \$3635 using the straight-line method.

- a) Calculate the rate of depreciation per year as a percentage of the original value.

2

$$\text{Dep} = (5000 - 3635) \div 3$$

$$= \$455 \text{ per year. } \textcircled{1}$$

$$\% = \frac{455}{5000} \times 100$$

$$= 9.1\% \textcircled{1}$$

- b) How long after the equipment was purchased will it have a salvage value of \$0?
Give your answer to the nearest whole year.

2

$$0 = 5000 - 455n \textcircled{1}$$

$$455n = 5000$$

$$n = \frac{5000}{455}$$

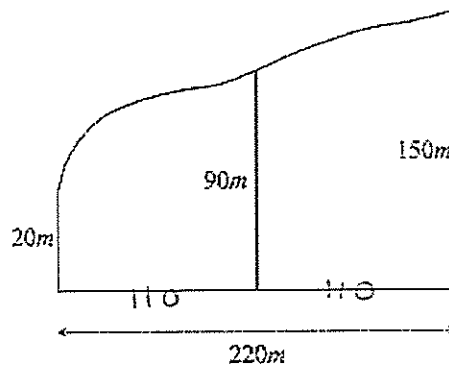
$$= 10.98... \text{ } \left. \begin{array}{l} \\ \end{array} \right\} \text{either } \textcircled{1}$$

$$= 11 \text{ years.}$$

Question 17

2

The diagram below represents a property that borders a river.



Use two applications of the trapezoidal rule to estimate the area of the property.

$$A = \frac{110}{2} (20 + 90) + \frac{110}{2} (90 + 150)$$

$$= 19250 \text{ m}^2$$

(1 mark for one application)

Question 18

A social club has invested \$3400 into an account which pays simple interest at the rate of 4.4% per annum.

- a) Calculate the interest the investment will earn over six years.

1

$$I = 3400 \times 4.4\% \times 6$$

$$= \$897.60$$

- b) Determine the total value of the investment after six years.

1

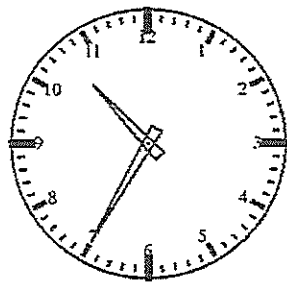
$$\text{Total} = 897.60 + 3400$$

$$= \$4297.60$$

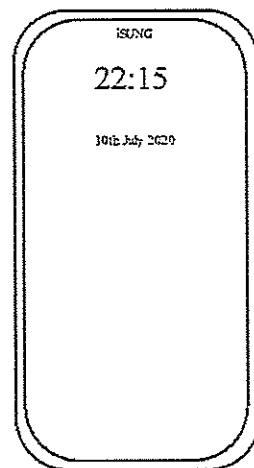
Question 19

1

On Monday morning, when Vernon caught a train, his phone was in his bag, so he glanced at the clock on the station platform to check the time. When he arrived at his destination later the same day, he took his phone out and checked the time. The two times are shown below.



10:35 am



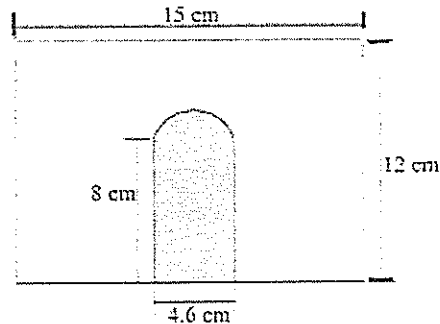
10:15 pm

How long did his journey take, in hours and minutes?

11 h 40 mins

Question 20

While they were out shopping, Hermione and Luna discovered Lego's Candy Bar. There were boxes in the shape of a medieval castle.



The doorway is a semi-circle on top of a rectangle. Calculate the area of the front of the box, without the door section, as shown above. Answer correct to one decimal place.

2

$$\begin{aligned}
 A &= (15 \times 12) - (8 \times 4.6 + \frac{1}{2} \times \pi \times 2.3^2) \\
 &= 180 - 45.109 \\
 &= 134.891 \dots \\
 &= 134.9 \text{ cm}^2
 \end{aligned}$$

1 mark for 45.109

Question 21

1

Part of a supermarket receipt is shown below.

XYZ Supermarket	
27/04/05 12.53	
MILK 1L	\$1.19
* PEPSI 1.25L	\$1.29
* DISINFECTANT	\$7.23
* TEA TREE OIL	\$4.13
SPINACH	\$1.64
SOUP	\$1.57
TOTAL	\$17.05
10% GST INCLUDED IN COST OF TAXABLE ITEMS	
* = TAXABLE ITEMS	

12.65

What is the amount of GST included in the total?

$$12.65 \div 11 = \$1.15$$

Question 22

- a) Complete the following table of values for the equation $y = 3x - 2$.

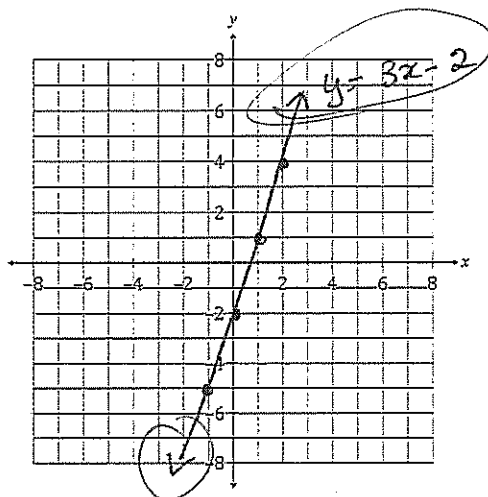
2

x	-1	0	1	2
y	-5	-2	1	4

-1 mark each mistake

- b) Draw the graph of $y = 3x - 2$ on the number plane below.

2



- c) What is the gradient and y- intercept of the line $y = 3x - 2$?

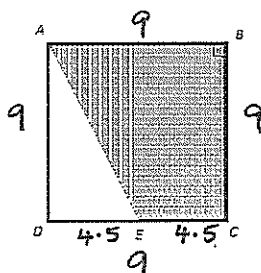
2

$m = 3$ $b = -2$

must indicate

Question 23

The square $ABCD$ drawn below has a perimeter of 36 cm.



The point E lies halfway between D and C . What is the perimeter, in centimetres, of the shaded trapezium? Answer correct to one decimal place.

2

$AC = \sqrt{9^2 + 4.5^2}$

$= 10.062...$ ①

Perimeter $= 9 + 9 + 4.5 + 10.062...$

$= 32.56...$

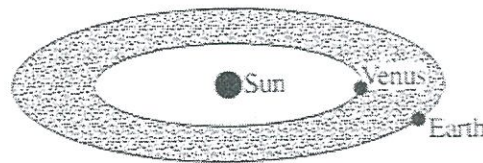
$= 32.6 \text{ cm}$

} either ①

Question 24

2

The orbits of Earth and Venus around the Sun are almost circular, and in the same plane.



- Earth is 1.496×10^8 km from the Sun.
- Venus is 1.082×10^8 km from the Sun

The formula for the area of an annulus is $A = \pi(R^2 - r^2)$ where R is the distance of Earth from the Sun and r is the distance of Venus from the Sun.

Treating the space between the orbits as an annulus, calculate its area.
Write your answer in scientific notation correct to two significant figures.

$$A = \pi \left[(1.496 \times 10^8)^2 - (1.082 \times 10^8)^2 \right]$$

$$= 3.352 \dots \times 10^{16}$$

$$= 3.4 \times 10^{16}$$

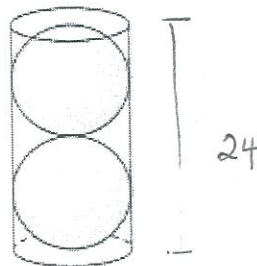
cfe \rightarrow must show $3.352 \dots \times 10^{16}$
or equivalent.

1 for scientific
1 for sig fig

Question 25

2

Two identical spheres fit exactly inside a cylindrical container, as shown.



The height of the cylinder is 24 cm.

Calculate the surface area of **one** sphere, correct to one decimal place.

$$\text{radius} = 6 \text{ cm}$$

$$SA = 4\pi \times 6^2 \quad \textcircled{1}$$

$$= 452.389 \dots$$

$$= 452 \text{ cm}^2$$

No marks
for finding V.

} either $\textcircled{1}$

$\textcircled{1}$

$$\begin{aligned} 24 \div 2 &= 12 \text{ radius} \\ 4 \times \pi \times 12^2 \\ &= 1809.55 \dots \end{aligned}$$

Question 26

A new shopping centre has opened near a primary school. A survey is conducted to determine the number of motor vehicles that pass the school each afternoon between 2.30 pm and 4.00 pm.

The results for 60 days have been recorded in the table and are displayed in the cumulative frequency histogram.

a) Complete the distribution table.

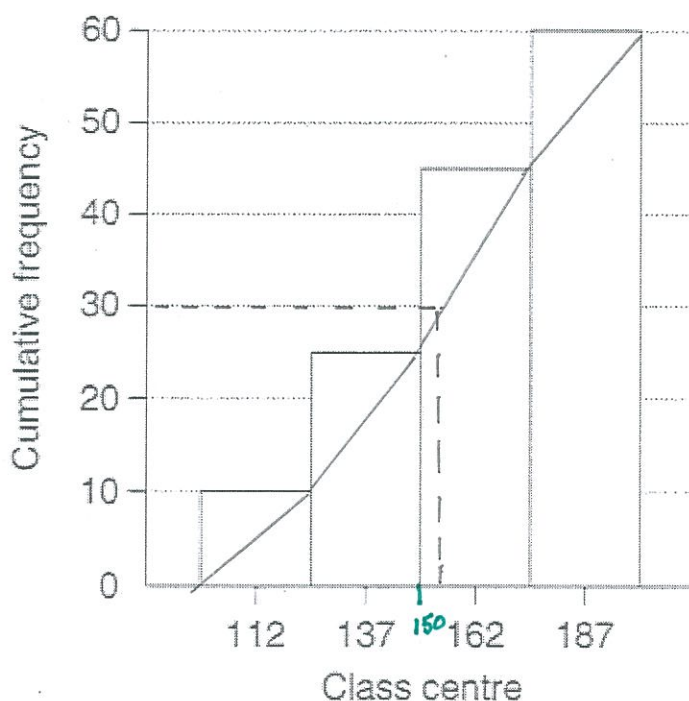
2

Score	Class centre	Frequency	Cumulative Frequency
100 – 124	112	10	10
125 – 149	137	15	25
150 – 174	162	20	45
175 – 199	187	15	60

-1 each error

b) The cumulative frequency histogram below displays the results for the data.

1



Draw a cumulative frequency polygon (ogive) on the graph.

c) Use your graph to determine the median. Show, by drawing lines on your graph, how you arrived at your answer.

1

150 → not 162.

approx 156. accept anything indicated on graph.

0 mark if not from graph

Question 27

2

The table below shows the number of kilojoules burned per kilogram of body weight in a 30-minute time period for various activities.

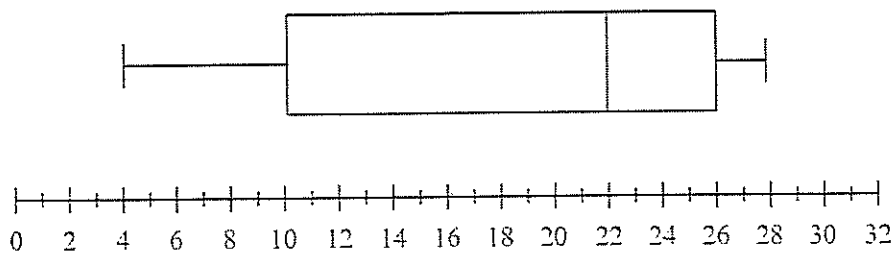
Activity	kJ/kg/30 mins
Cycling	11.7
Jogging	17.8
Running	27.9
Swimming	11.5
Walking	8.1
Weight training	17.5

Cho Chang has a body weight of 55 kg and spends 50 minutes on training each day. One day she spent thirty minutes cycling and 20 minutes swimming. How many kilojoules did she burn in her training session?

$$\begin{aligned}
 & 643.5 \quad 421.666... \\
 & (11.7 \times 55) + (11.5 \times \frac{20}{30} \times 55) \leftarrow \text{1 mark for 1 combination} \\
 & = 1065.16 \\
 & = 1065 \text{ kilojoules} \quad \left. \vphantom{\begin{aligned} & (11.7 \times 55) + (11.5 \times \frac{20}{30} \times 55) \\ & = 1065.16 \end{aligned}} \right\} \text{accept either}
 \end{aligned}$$

Question 28

The box plot below shows the distribution of class sizes (number of students) in a school which has 64 separate classes.



- a) What percentage of classes had a size between 10 students and 22 students?

1

$$\begin{aligned}
 & 25\% \\
 & \dots\dots\dots
 \end{aligned}$$

- b) How many classes had a size greater than 22 students?

1

$$\begin{aligned}
 & 0.5 \times 64 = 32 \text{ students} \\
 & \dots\dots\dots
 \end{aligned}$$

Question 29

2

The cost of a jewellery box varies directly with the cube of its height. A jewellery box with a height of 10 cm costs \$50. Calculate the cost of a jewellery box with a height of 12 cm.

$$C = kh^3$$

$$50 = k \times 10^3$$

$$\frac{50}{1000} = k$$

$$\textcircled{1} \quad \frac{1}{20} = k$$

$$C = \frac{1}{20} \times 12^3$$

$$= \$86.40 \quad \textcircled{1}$$

Question 30

Draco records the number of minutes he spends exercising on 17 days. The data is displayed in the stem and leaf plot below.

Minutes of Exercise per Day

1	8
2	2 4
3	2 3 4 6 9
4	$\textcircled{1}$ 3 6 7
5	0 3 5
6	3
7	9

a) What is the mean and standard deviation of the data, correct to two decimal places?

2

$$\bar{x} = 42.06 \quad \textcircled{1} \quad \text{SD} = 14.94 \quad \textcircled{1}$$

b) What is the interquartile range of the data?

1

$$\text{IQR} = 51.5 - 32.5$$

$$= 19$$

c) Is the score 79 an outlier? Justify your answer with appropriate calculations.

2

$$51.5 + 1.5 \times 19$$

$$\textcircled{1} \rightarrow = 80$$

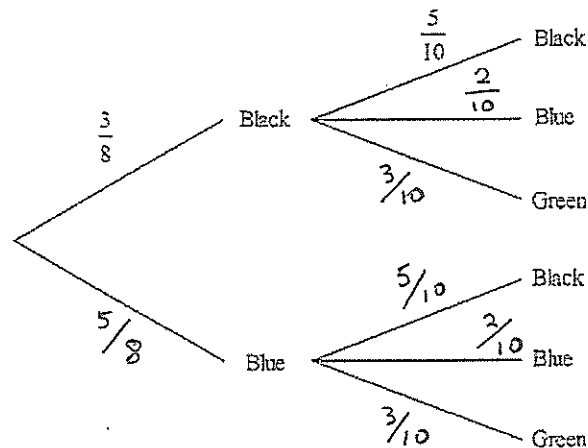
$$\textcircled{1} \rightarrow 79 < 80 \quad \therefore 79 \text{ is not an outlier.}$$

Question 31

At the Fun Socks Shop there are two boxes of coloured socks. Minerva must randomly pick one sock from each box. The first box contains 3 black sock and 5 blue socks. The second box contains 5 black sock, 2 blue socks and 3 green socks.

a) Complete the probability tree diagram below.

2



-1 each error

b) What is the probability of picking a blue sock from the first box?

1

$\frac{5}{8}$

c) What is the probability of picking a pair of socks of the same colour?

2

$$\left(\frac{3}{8} \times \frac{5}{10}\right) + \left(\frac{5}{8} \times \frac{2}{10}\right)$$

$$= \frac{5}{16}$$

Question 32

1

Dudley is 24, single with no children and lives away from home.

Your circumstances	Your maximum fortnightly payment
Single, no children, younger than 18, and live at your parent's home	\$249.20
Single, no children, younger than 18, and need to live away from your parent's home to study, train or look for work	\$455.20
Single, no children, 18 or older and live at parent's home	\$299.20
Single, no children, 18 or older and need to live away from parent's home	\$455.20
Single, with children	\$596.50
Member of a couple, with no children	\$455.20
Member of a couple, with children	\$499.90

What is the maximum youth allowance that Dudley could receive per fortnight?

\$455.20

Question 33

The number of 'standard drinks' in various glasses of wine is shown in the table below.

Number of standard drinks			
White Wine		Red Wine	
small glass	large glass	small glass	large glass
0.9	1.4	1.0	1.5

A woman weighing 62 kg drinks three small glasses of white wine and two large glasses of red wine between 8 pm and 1 am.

2

Using the formula $BAC_{Female} = \frac{10N - 7.5H}{5.5M}$, calculate her blood alcohol content (BAC) estimate at 1 am. Answer correct to three decimal places.

$$BAC = \frac{10(3 \times 0.9 + 1.5 \times 2) - 7.5 \times 5}{5.5 \times 62} \quad \textcircled{1}$$

$$= 0.0571 \quad \textcircled{1}$$

$$= 0.057$$

Question 34

Dolores boards a plane in New York at 6 am on Wednesday 7th August, flying to Sydney. Sydney's time zone is UTC +10 and New York's is UTC - 5.

a) What is the time difference between the two cities?

1

15 hours

b) If the flight takes 20 hours from time of boarding, what is the local time, day and date when she disembarks in Sydney?

2

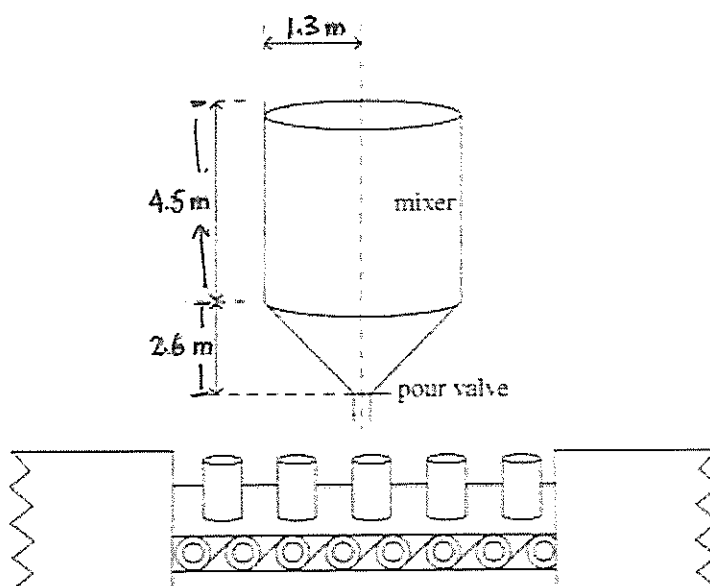
6 am + 20 hrs = 2 am Thurs 8th — $\textcircled{1}$

+ 15 hours

= 5 pm Thurs 8th — $\textcircled{1}$

Question 35

The diagram below shows one section of a factory production line that fills cylindrical cans with soup from a mixer.



The mixer is in the shape of a cylinder on top of an inverted cone.

- a) Calculate the volume of the cylinder. Answer correct to one decimal place.

1

$$\begin{aligned}
 V &= \pi \times 1.3^2 \times 4.5 \\
 &= 23.89... \\
 &= 23.9 \text{ m}^3
 \end{aligned}
 \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{either}$$

- b) The mixer is in the shape of a cylinder on top of an inverted cone.

3

Calculate the capacity of the entire mixer in litres. ($1 \text{ m}^3 = 1000 \text{ litres}$)

$$\begin{aligned}
 V \text{ of cone} &= \frac{1}{3} \times (\pi \times 1.3^2) \times 2.6 \\
 &= 4.601... \text{ ①}
 \end{aligned}$$

$$\begin{aligned}
 V \text{ of mixer} &= 23.9 + 4.601... \\
 &= 28.501... \text{ cm}^3 \text{ ①}
 \end{aligned}$$

$$\therefore 28501 \text{ L ①}$$

- c) The capacity of a small soup can is 375 mL. How many small cans of soup can be filled with the contents of the mixer?

2

$$\begin{aligned}
 &0.375 \text{ L per can} \\
 28501 \div 0.375 &= 76002.6... \text{ ①} \\
 &= 76002 \text{ cans ①}
 \end{aligned}$$

Question 36

5

George has earned a gross annual salary of \$102 500 in 2019-2020 and his employer has paid \$27 500 PAYG tax on his behalf. He has calculated that his total allowable deductions were \$1280 for work-related travel, \$350 for stationery and \$450 for professional subscriptions.

George must pay the Medicare levy of 2% on his taxable income.

Using the tax table provided by the ATO below, determine how much George's tax refund or tax debt will be.

<i>Taxable income</i>	<i>Tax payable</i>
0–\$18 200	Nil
\$18 201–\$37 000	Nil + 19 cents for each \$1 over \$18 200
\$37 001–\$80 000	\$3572 + 32.5 cents for each \$1 over \$37 000
\$80 001–\$180 000	\$17 547 + 37 cents for each \$1 over \$80 000
\$180 001 and over	\$54 547 + 45 cents for each \$1 over \$180 000

$$\begin{aligned} \text{Taxable income} &= 102\,500 - (1\,280 + 350 + 450) \\ &= \$100\,420 \quad (1) \end{aligned}$$

$$\begin{aligned} \text{Medicare} &= 100\,420 \times 2\% \\ &= \$2\,008.40 \quad (1) \end{aligned}$$

$$\begin{aligned} \text{tax payable} &= 17\,547 + (100\,420 - 80\,000) \times 0.37 \\ &= \$25\,102.40 \quad (1) \end{aligned}$$

$$\begin{aligned} \text{total tax} &= 25\,102.40 + 2\,008.40 \\ &= \$27\,110.80 \quad (1) \end{aligned}$$

must indicate
refund

$$\begin{aligned} \text{Refund} &= 27\,500 - 27\,110.80 \\ &= \$389.20 \quad (1) \end{aligned}$$

Section II Extra writing space

If you use this space, clearly indicate which question you are answering.

[illegible]

2020 Year 11 Final Examination

Mathematics Standard 1 Mathematics Standard 2

REFERENCE SHEET

Measurement

Precision

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

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

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

Length, area, surface area and volume

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

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

$$A = \frac{h}{2}(x + y)$$

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

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

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

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

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

Trigonometry

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

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

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

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

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

$$z = \frac{x - \bar{x}}{s}$$

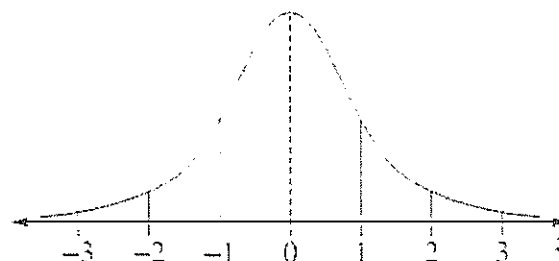
An outlier is a score

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

or

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

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

