

Student Name: \_\_\_\_\_

2014  
**YEAR 12**  
 YEARLY EXAMINATION

# Mathematics General 2

### General Instructions

- Reading time - 5 minutes
- Working time - 2.5 hours
- Write using black or blue pen
- Board-approved calculators may be used
- A formula and data sheet is provided at the back of this paper
- In Questions 26-30, show relevant mathematical reasoning and/or calculations

### Total marks - 100

#### Section I

25 marks

- Attempt Questions 1-25
- Allow about 35 minutes for this section

#### Section II

75 marks

- Attempt Questions 26-30
- Allow about 1 hour 55 minutes for this section

### Section I

25 marks

Attempt Questions 1 - 25

Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1-25

- 1 The stem-and-leaf plot shows the number of trains departing Parramatta railway station and Strathfield railway station every 30 minutes on a Monday.

Parramatta		Strathfield
4 4	0	2 5 6
8 7 7 5 1 1 0	1	0 2 4 8 8 8 9
3 2 1		3 3

What is the median number of trains departing Strathfield railway station?

- (A) 13  
 (B) 14  
 (C) 16  
 (D) 18
- 2 A water tank is being emptied of liquid at a rate of 5 litres per minute. How long will it take for a kilolitre of water to empty from the water tank at this rate?
- (A) 20 min  
 (B) 1000 min  
 (C) 3 h 20 min  
 (D) 3 h 33 min
- 3 Players in a basketball competition are asked to write down their heights. Which of the following best describes this data?
- (A) Categorical  
 (B) Continuous  
 (C) Discrete  
 (D) Stratified
- 4 Calculate the surface area of a closed hemisphere with a radius of 5 m. Answer correct to two decimal places.
- (A) 78.54 m<sup>2</sup>  
 (B) 157.08 m<sup>2</sup>  
 (C) 235.62 m<sup>2</sup>  
 (D) 314.16 m<sup>2</sup>

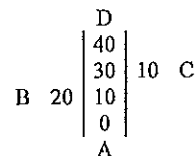
- 5 Mia is buying a car which has a cash price of \$35 000. She pays a deposit of \$10 000 and will pay \$610 per month for the next 5 years. How much would she have saved by paying cash for the car?
- (A) \$1 600  
 (B) \$8 400  
 (C) \$10 000  
 (D) \$11 600

- 6 The base length  $l$  of a square pyramid of volume  $V$  and perpendicular height  $h$  is given by the formula:  $l = \sqrt{\frac{3V}{h}}$ .

Find  $l$  correct to one decimal place if  $V = 652$  and  $h = 7.8$ .

- (A) 5.7  
 (B) 15.8  
 (C) 250.8  
 (D) 700.4
- 7 Which one of the following groups of scores has a mean of 60 and a median of 50?
- (A) 30, 40, 50, 50, 70, 80  
 (B) 40, 45, 45, 55, 85, 90  
 (C) 10, 50, 60, 70, 80, 90  
 (D) 40, 40, 45, 55, 70, 90

- 8 What is the area of ABCD using the field book entry?



- (A) 40  
 (B) 450  
 (C) 600  
 (D) 1200
- 9 A map has a scale of 1:5000. If George St is 650 m, what is the map distance of George St?
- (A) 0.13 mm  
 (B) 13 mm  
 (C) 130 mm  
 (D) 1300 mm

- 10 What is the value of  $y$ , if  $x = 2\sqrt{y}$ ?

- (A)  $4x$   
 (B)  $2x^2$   
 (C)  $\frac{x^2}{4}$   
 (D)  $4x^2$

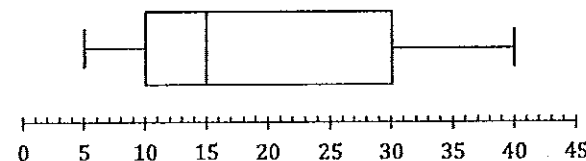
- 11 The careers advisor of a high school determined the number of last year's HSC students who joined the workforce or continued with further study.

Gender	Workforce	Study
Male	31	69
Female	29	76

What is the probability that a female student selected at random from the last year's HSC students would have joined the workforce?

- (A)  $\frac{29}{205}$   
 (B)  $\frac{29}{105}$   
 (C)  $\frac{29}{100}$   
 (D)  $\frac{29}{60}$

- 12 There were 120 students who completed an assessment task. The maximum mark was 50.



Which of the following statements is false?

- (A) 30 students scored a mark less than 10.  
 (B) The distribution of the scores is negatively skewed.  
 (C) The median score is 15.  
 (D) 90 students achieved a score greater than the lower quartile.

13 A medium sized car travelled 640 km using 48 L of petrol. What was the fuel consumption?

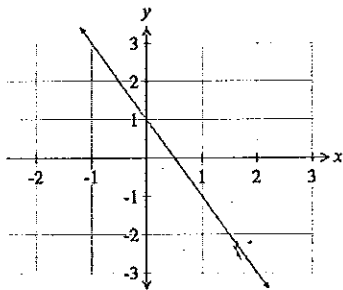
- (A) 1.1 L/100 km
- (B) 7.5 L/100 km
- (C) 9.0 L/100 km
- (D) 13.3 L/100 km

14 The time taken ( $t$ ), in hours, to pave a footpath varies inversely with the number of people ( $n$ ) working. It takes 4 people 16 hours to pave a footpath. How long would it take 3 people to pave the same footpath?

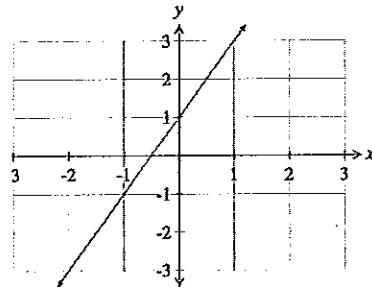
- (A) 1 hour 33 minutes
- (B) 12 hours
- (C) 21 hours 20 minutes
- (D) 21 hours 33 minutes

15 Which of these diagrams represents the graph of  $y = 1 - 2x$  ?

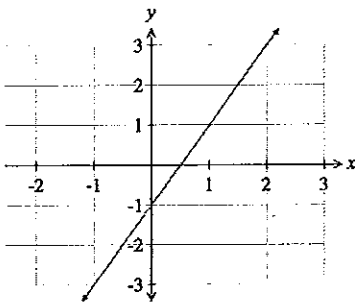
(A)



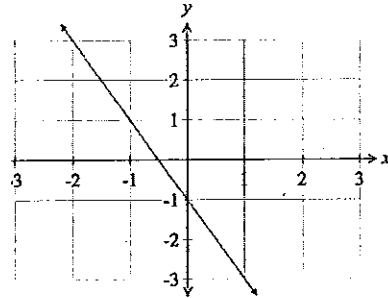
(B)



(C)



(D)



16 Find the volume using Simpson's rule and the following set of data:

$$h = 15 \text{ m}, A_1 = 12 \text{ m}^2, A_n = 16 \text{ m}^2 \text{ and } A_2 = 14 \text{ m}^2.$$

- (A)  $57 \text{ m}^3$
- (B)  $90 \text{ m}^3$
- (C)  $390 \text{ m}^3$
- (D)  $450 \text{ m}^3$

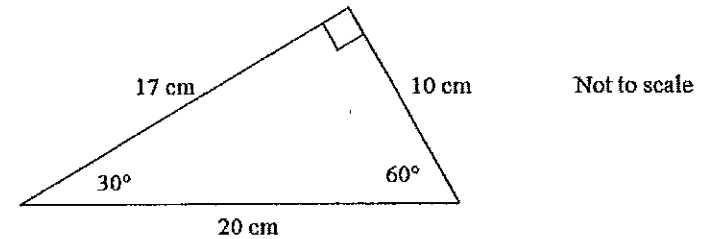
17 Two cities  $A$  and  $B$  both lie on the Equator and have respective longitudinal positions of  $110^\circ\text{W}$  and  $150^\circ\text{E}$ . What is the time in city  $A$ , when it is 11.15 pm on Monday in city  $B$ ?

- (A) 10.43 am Tuesday
- (B) 5.55 am Monday
- (C) 10.35 am Tuesday
- (D) 7.55 pm Monday

18 Abigail and Hannah work in a supermarket and earned \$800 last week. Abigail worked 4 hours more than Hannah and was paid double-time for these hours. What is Hannah's hourly wage rate if Abigail is paid an hourly wage rate of \$20?

- (A) \$15
- (B) \$20
- (C) \$25
- (D) \$30

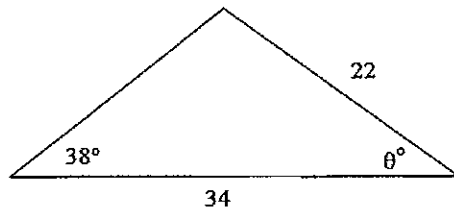
19



Which of the following expressions gives the area of the triangle?

- (A)  $\frac{1}{2} \times 10 \times 20$
- (B)  $\frac{1}{2} \times 10 \times 17$
- (C)  $\frac{1}{2} \times 10 \times 17 \times \sin 60^\circ$
- (D)  $\frac{1}{2} \times 17 \times 20 \times \sin 60^\circ$

- 20 What is the  $y$ -intercept of the least-squares regression line given  $m = 0.9$ ,  $\bar{x} = 40.10$  and  $\bar{y} = 60.44$ ?
- (A)  $-14.296$  (B)  $24.35$   
 (C)  $94.496$  (D)  $96.53$
- 21 Two thousand fish were caught from a lake, tagged and released into the same lake. Some time later, a sample of 5000 fish were taken. In this sample, 1066 tagged fish were found. Which of the following is the best estimate, to the nearest hundred, for the number of fish in the lake?
- (A) 2700 (B) 6100  
 (C) 7000 (D) 9400
- 22 How many files of average size 1.5 MB can be stored on a 16 GB USB drive?
- (A) 11 (B) 24  
 (C) 10 923 (D) 24 576
- 23 The probability that a kitten will be alive 12 months after birth is 0.8. Two kittens were born on the same day. What is the probability that at least one of them will be alive six months later?
- (A) 0.32 (B) 0.64  
 (C) 0.80 (D) 0.96
- 24 Find the size of angle  $\theta$  to the nearest degree.



Not to scale

- (A)  $70^\circ$   
 (B)  $72^\circ$   
 (C)  $95^\circ$   
 (D)  $107^\circ$
- 25 Rewrite the formula  $V = 3r^2h + 9$  with  $r^2$  as the subject.

- (A)  $r^2 = \frac{V-9}{3h}$  (B)  $r^2 = \frac{V-3h}{9}$   
 (C)  $r^2 = \sqrt{\frac{V-3h}{9}}$  (D)  $r^2 = \sqrt{\frac{V-9}{3h}}$

**Section II**

75 marks  
 Attempt Questions 26–30  
 Allow about 1 hour and 55 minutes for this section

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

**Question 26 (15 marks)** **Marks**

- (a) Matthew borrows \$15000 from a bank and is charged an annual flat interest rate of 7.5%. He agrees to repay the loan in equal monthly repayments over a period of 8 years.
- (i) What is the interest Matthew is charged each year? 1
- \_\_\_\_\_
- \_\_\_\_\_
- (ii) What is the total amount to be repaid on the loan? 2
- \_\_\_\_\_
- \_\_\_\_\_
- (iii) Calculate the amount of each monthly repayment. 1
- \_\_\_\_\_
- \_\_\_\_\_
- (b) Solve the equation  $5y + 3(2 - y) = \frac{2y}{3} + 12$  2

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- (c) Thomas is planning a trip with his friends. The cost of hiring a van is \$960. The table below shows the cost per person for various numbers of people.

Number of people	1	2	3	4	$n$
Cost	\$960	\$480	\$320	\$240	$A$

- (i) Find an expression for  $A$  in the table. 1

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- (ii) How many people are needed so that the cost per person is \$40? 1

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- (iii) Thomas has a large number of friends. Is it possible that he can get the tickets for \$10 each? Give a reason for your answer. 1

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- (d) Mr Johns needs to give his son some medicine. His son is 7 years old and weights 22.5 kg. He is using the rule  $D = \frac{kA}{70}$  (where  $k$  is the weight of the child in kilograms and  $A$  is the adult dosage) to calculate the dose of medicine for his son. The adult dosage is 12 mL every morning and 12 mL every night. How many days will a 375 mL bottle of medicine last for his son? 2

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- (e) Blake bought a new car for \$45 000. The table below shows the depreciated value of the car for the first 4 years using straight-line method and declining balance method.

Year	A	B
1	\$40 000	\$38 250
2	\$35 000	\$32 512.50
3	\$30 000	
4	\$25 000	

- (i) Why is column A the straight-line method of depreciation? 1

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- (ii) Show that the declining balance rate of depreciation of 15% was applied in column B. 1

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- (iii) When will the depreciated value of the car fall below \$10 000 using the declining method of depreciation? 2

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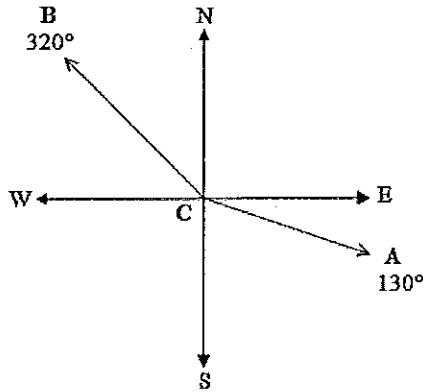
**Question 27 (15 marks)**

**Marks**

- (a) Ship *A* and *B* leave port *C* at 11.00 am in different directions.

Ship	Bearing from C	Speed
<i>A</i>	320°	25 km/h
<i>B</i>	130°	40 km/h

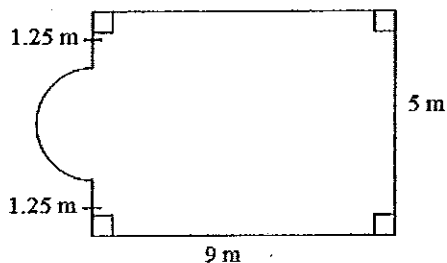
The diagram below shows the courses of each of the ships from port *C*.



- (i) Calculate the distance travelled by each ship by 4.00 pm. 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (ii) What is the size of  $\angle ACB$ ? 1
- \_\_\_\_\_
- \_\_\_\_\_
- (iii) What is the distance *AB* between the ships at 4.00 pm? Answer correct to the nearest kilometre. 2
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- (b) A bag contains eighteen white golf balls and two yellow golf balls. Daniel randomly selects one ball from the bag and hits it. He then selects another ball from the bag and hits it.
- (i) What is the probability that the first ball hit is yellow? 1
- \_\_\_\_\_
- \_\_\_\_\_
- (ii) What is the probability that both balls are yellow? 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (iii) What is the probability that only one ball is yellow? 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (c) Jake owns a store credit card that has no annual fee and charges 18.4% p.a. interest on all purchases made. The interest is charged from the day of purchase, including the day of purchase.
- (i) Show that the daily interest rate is 0.0504%. 1
- \_\_\_\_\_
- \_\_\_\_\_
- (ii) On the 18<sup>th</sup> of May, Jake bought a new laptop for \$725 using his store credit card. Jake paid her credit card account on the 4<sup>th</sup> of June. What was the total amount he paid for the laptop, including interest? Answer to the nearest five cents 2
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- (d) A swimming pool is rectangular with a semicircular shape at one end. The plan of a swimming pool is shown below. It is not to scale.



- (i) What is the distance around the outside of the pool? Answer correct to two decimal places. 2

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- (ii) Calculate the area of the surface of the pool. Answer correct to two decimal places. 2

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- (iii) The pool has a constant depth of 1.6 m. What is the volume of water required to fill the pool? Give your answer to the nearest cubic metre. 1

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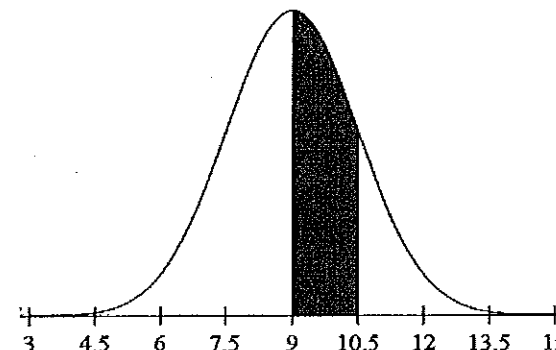
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Question 28 (15 marks)

Marks

- (a) The bell-shaped curve shows the distribution of the weights of 1200 packages received by the Australian customs service during one week.



The mean of this distribution is 9 kg and the standard deviation is 1.5 kg.

- (i) What is the weight of a package with a z-score of  $-2.5$ ? 1

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- (ii) How many packages were received during the week with weights within the range represented by the shaded section? 1

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- (iii) What percentage of the packages weighed less than 7.5 kg? 2

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- (iv) Comment on the chance of the Australian custom service receiving a package weighing 15 kg. 1

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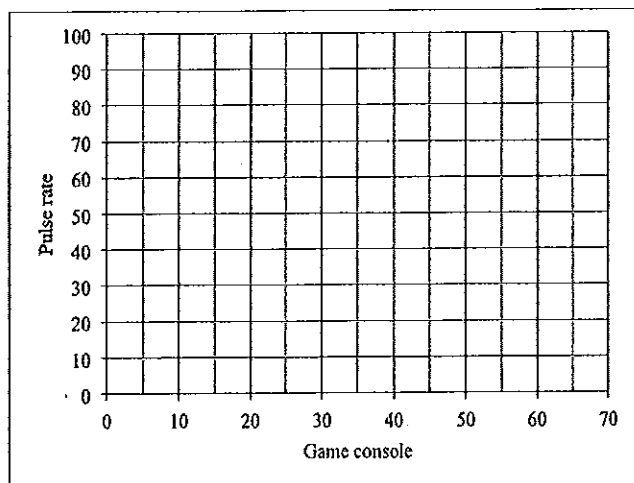
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(b) The table shows a student's score on a game console and their pulse rate.

Game console (x)	5	7	18	20	30	43	50	58	60	65
Pulse rate (y)	97	93	85	77	75	64	70	64	60	55

(i) Draw a scatterplot and a line of best fit.

2



(ii) Write an equation for the line of best fit.

1

(iii) Calculate the value of the correlation coefficient. Answer correct to 2 decimal places.

1

(c) The time (in seconds) recorded for Jack and Ryan in a 100-metre race is shown below.

Jack	14.21	11.34	11.59	10.99	15.75	14.87	15.98
Ryan	13.23	12.99	11.27	12.08	14.21	11.98	14.66

(i) Which person recorded the smallest range of times?

1

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(ii) Calculate the mean and population standard deviation for these times for both Jack and Ryan. Answer correct to one decimal place.

2

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(iii) Which person recorded the largest interquartile range?

1

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(iv) Comment on the skewness of Jack's times?

1

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(v) Who is the better 100-metre runner? Justify your answer.

1

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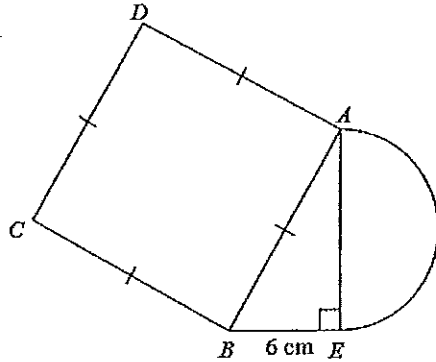
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Question 29 (15 marks)

Marks

- (a) A piece of aluminium consists of a semicircle, a right triangle and a square. The radius of the circle is 4 cm and  $BE = 6$  cm.



- (i) What is the length of  $AE$ ? 1

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- (ii) Calculate  $\angle ABE$ . Answer to the nearest degree. 1

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- (iii) Show that the length of  $AB$  is 10 cm. 1

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- (iv) Calculate the total area of this piece of aluminium. Answer correct to the nearest square centimetre. 2

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- (b) There are 16 players in the training squad for a volleyball team. 1

- (i) The coach chooses two players to be the captain and vice-captain. How many arrangements of captain and vice-captain are possible? 1

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- (ii) Four players are selected to make up the remainder of the team after the captain and vice-captain have been chosen. How many possible selections are there? 1

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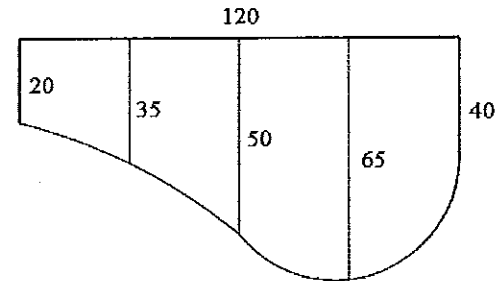


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- (c) The area of a field is shown below. All measurements are metres



- Use two applications of Simpson's rule to approximate the area of the field. 2

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- (d) The stopping distance,  $d$  metres, of a motor vehicle travelling at a speed of  $v$  kilometres per hour is given by the formula.

$$d = \frac{v^2 + 10v}{200}$$

- (i) The table below contains values of the stopping distance  $d$  for some values of the speed  $v$ . Complete the table. 1

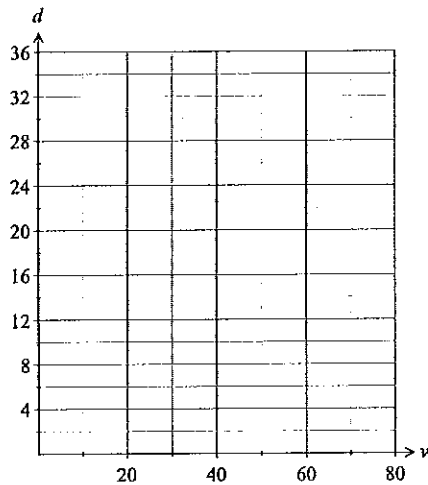
$v$	0	20	40	60	80
$d$		3		21	36

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- (ii) Plot the points on the graph below. 1




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- (iii) Use the graph to estimate the maximum speed at which the motor vehicle can be moving and still be able to stop within 30 metres. 1

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- (e) The table below shows a two mobile phone plans.

		\$49 plan	\$69 plan
Monthly Access Fee		\$49.00	\$69.00
Included allowance		\$500.00	\$800.00
Connection fee - Flagfall		\$0.32	\$0.35
Call Rates (per minute)		\$0.90	\$0.88
Messaging	SMS	\$0.23	\$0.23
	MMS	\$0.40	\$0.40

- (i) What is the charge for a call lasting 3 minutes and 20 seconds on the \$49 plan? 1

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- (ii) What is the maximum number of free calls (60 seconds) on the \$69 plan? 1

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- (iii) Determine the monthly charge for making 400 calls (60 seconds) on the \$49 plan? 1

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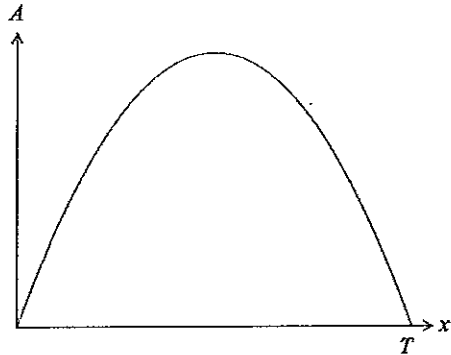


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**Question 30 (15 marks)**

**Marks**

- (a) The area ( $A$ ) of a rectangular yard with a length  $x$  metres is given by the formula:  $A = 30x(15 - x)$  where  $A$  is in square metres. The graph of  $A$  against different values of  $x$  is shown below.



- (i) Complete the following table of values.

2

$x$	0	5	10	15
$A$				

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- (ii) What is the value of  $T$  on the graph?

1

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- (iii) Calculate the maximum area of the yard.

2

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- (b) A boat leaves Nauru ( $1^\circ\text{S}$ ,  $167^\circ\text{E}$ ) and travels to Vanuatu ( $16^\circ\text{S}$ ,  $167^\circ\text{E}$ ).

- (i) Find the distance the boat has travelled between Nauru and Vanuatu. Answer correct to the nearest kilometre. 1

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- (ii) The boat travels at an average speed of 15 km/h. How many hours and minutes will it take to travel from Nauru and Vanuatu? 1

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- (iii) The boat leaves Nauru at 8.00 a.m. on Wednesday, 17<sup>th</sup> August. What is the date and time of arrival of the boat in Vanuatu? 2

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- (c) Solve the following pair of simultaneous equations. 2

$$\begin{aligned} 4x - y &= 6 \\ 3x + 2y &= -1 \end{aligned}$$

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- (d) Tahlia and Hamish borrowed \$465 000 at 8% p.a. reducible interest. The interest is charged monthly and the monthly repayment is \$3550. The table shows the amounts owing during the first three months

Months	Principal	Interest	$P + I$	$P + I - R$
1	\$465 000	\$3100	\$468 100	\$464 550
2		\$3097	\$467 647	
3	\$464 097			

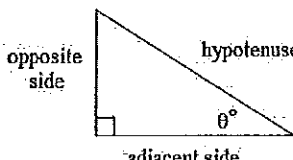
- (i) What is the principal at the beginning of the second month? 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (ii) How much is owed at the end of the second month? 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (iii) Calculate the interest to be paid at the beginning of the third month? 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- (iv) How much is owed at the end of the third month? 1
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

End of paper

FORMULAE AND DATA SHEET

Financial Mathematics	Data Analysis
<p><b>Simple interest</b></p> $I = Prn$ <p><math>P</math> is initial amount  <math>r</math> is interest rate per period, expressed as a decimal  <math>n</math> is number of periods</p>	<p><b>Mean of a sample</b></p> $\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$ <p><b>z-score</b></p> <p>For any score <math>x</math>,</p> $z = \frac{x - \bar{x}}{s}$ <p><math>\bar{x}</math> is mean  <math>s</math> is standard deviation</p>
<p><b>Compound interest</b></p> $A = P(1+r)^n$ <p><math>A</math> is final amount  <math>P</math> is initial amount  <math>r</math> is interest rate per period, expressed as a decimal  <math>n</math> is number of compounding periods</p>	<p><b>Outlier(s)</b></p> <p>score(s) less than <math>Q_L - 1.5 \times IQR</math> or              score(s) more than <math>Q_U + 1.5 \times IQR</math></p> <p><math>Q_L</math> is lower quartile  <math>Q_U</math> is upper quartile  <math>IQR</math> is interquartile range</p>
<p><b>Present value and future value</b></p> $PV = \frac{FV}{(1+r)^n}, FV = PV(1+r)^n$ <p><math>r</math> is interest rate per period, as expressed as a decimal  <math>n</math> is number of compounding periods</p>	<p><b>Least-squares line of best fit</b></p> <p><math>y = \text{gradient} \times x + y\text{-intercept}</math></p> $\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$ <p><math>y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})</math></p> <p><math>r</math> is correlation coefficient  <math>\bar{x}</math> is mean of <math>x</math> score  <math>\bar{y}</math> is mean of <math>y</math> scores</p>
<p><b>Straight-line method of depreciation</b></p> $S = V_0 - Dn$ <p><math>S</math> is salvage value of asset after <math>n</math> periods  <math>V_0</math> is initial value of asset  <math>D</math> is amount of depreciation per period  <math>n</math> is number of periods</p>	<p><b>Normal distribution</b></p> <ul style="list-style-type: none"> <li>• approximately 68% of scores have z-scores between <math>-1</math> and <math>1</math></li> <li>• approximately 95% of scores have z-scores between <math>-2</math> and <math>2</math></li> <li>• approximately 99.7% of scores have z-scores between <math>-3</math> and <math>3</math></li> </ul>
<p><b>Declining-balance method of depreciation</b></p> $S = V_0(1-r)^n$ <p><math>S</math> is salvage value of asset after <math>n</math> periods  <math>V_0</math> is initial value of asset  <math>r</math> is depreciation rate per period, expressed as a decimal  <math>n</math> is number of periods</p>	

Spherical Geometry	Surface Area
<p><b>Circumference of a circle</b>  <math>C = 2\pi r</math> or <math>C = \pi d</math>  <math>r</math> is radius  <math>d</math> is diameter</p> <p><b>Arc length of a circle</b>  <math>l = \frac{\theta}{360} 2\pi r</math>  <math>r</math> is radius  <math>\theta</math> is number of degrees in central angle</p> <p><b>Radius of Earth</b>                      (taken as) 6400 km</p> <p><b>Time differences</b>                      For calculation of time differences using longitude: <math>15^\circ = 1</math> hour time difference</p>	<p><b>Sphere</b>  <math>A = 4\pi r^2</math>  <math>r</math> is radius</p> <p><b>Closed cylinder</b>  <math>A = 2\pi r^2 + 2\pi rh</math>  <math>r</math> is radius  <math>h</math> is perpendicular height</p>
	Volume
	<p><b>Prism or cylinder</b>  <math>V = Ah</math>  <math>r</math> is radius  <math>h</math> is perpendicular height</p> <p><b>Pyramid or cone</b>  <math>V = \frac{1}{3} Ah</math>  <math>A</math> is area of the base  <math>h</math> is perpendicular height</p>
	Volume and capacity
	unit conversion: $1 \text{ m}^3 = 1000 \text{ L}$
	Approximation Using Simpson's Rule
	<p><b>Area</b>  <math>A \approx \frac{h}{3} (d_f + 4d_m + d_l)</math>  <math>h</math> distance between successive measurements  <math>d_f</math> is first measurement  <math>d_m</math> is middle measurement  <math>d_l</math> is last measurement</p> <p><b>Volume</b>  <math>V \approx \frac{h}{3} (A_L + 4A_M + A_R)</math>  <math>h</math> distance between successive measurements  <math>A_L</math> is area of left end  <math>A_M</math> is area of middle  <math>A_R</math> is area of right end</p>
<p><b>Circle</b>  <math>A = \pi r^2</math>  <math>r</math> is radius</p> <p><b>Sector</b>  <math>A = \frac{\theta}{360} \pi r^2</math>  <math>r</math> is radius  <math>\theta</math> is number of degrees in central angle</p> <p><b>Annulus</b>  <math>A = \pi(R^2 - r^2)</math>  <math>R</math> is radius of outer circle  <math>r</math> is radius of inner circle</p> <p><b>Trapezium</b>  <math>A = \frac{h}{2} (a + b)</math>  <math>h</math> is perpendicular height  <math>a</math> and <math>b</math> are the lengths of the parallel sides</p> <p><b>Area of land and catchment areas</b>                      unit conversion: <math>1 \text{ ha} = 10\,000 \text{ m}^2</math></p>	

Trigonometric Ratios	Blood Alcohol Content Estimates
 <p>opposite side</p> <p>hypotenuse</p> <p>adjacent side</p> <p><math>\theta^\circ</math></p> <p><math>\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}</math></p> <p><math>\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}</math></p> <p><math>\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}</math></p> <p><b>Sine rule</b>                      In <math>\triangle ABC</math></p> $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ <p><b>Cosine rule</b>                      In <math>\triangle ABC</math></p> $c^2 = a^2 + b^2 - 2ab \cos C$ <p>or</p> $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$	<p><math>BAC_{Male} = \frac{(10N - 7.5H)}{6.8M}</math> or</p> <p><math>BAC_{Female} = \frac{(10N - 7.5H)}{5.5M}</math></p> <p><math>N</math> is number of standard drinks consumed  <math>H</math> is number of hours of drinking  <math>M</math> is person's mass in kilograms</p>
	Distance, Speed and Time
	<p><math>D = ST, S = \frac{D}{T}, T = \frac{D}{S}</math></p> <p>average speed = <math>\frac{\text{total distance travelled}}{\text{total time taken}}</math></p> <p>stopping distance = <math>\left\{ \begin{array}{l} \text{reaction-time} \\ \text{distance} \end{array} \right\} + \left\{ \begin{array}{l} \text{braking} \\ \text{distance} \end{array} \right\}</math></p>
	Probability of an Event
	<p>The probability of an event where outcomes are equally likely is given by:</p> $P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$
	Straight Lines
	<p><b>Gradient</b></p> $m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$ <p><b>Gradient-intercept form</b>  <math>y = mx + b</math>  <math>m</math> is gradient  <math>b</math> is y-intercept</p>
Units of Memory and File Size	
<p>1 byte = 8 bits</p> <p>1 kilobyte = <math>2^{10}</math> bytes = 1024 bytes</p> <p>1 megabyte = <math>2^{20}</math> bytes = 1024 kilobytes</p> <p>1 gigabyte = <math>2^{30}</math> bytes = 1024 megabytes</p> <p>1 terabyte = <math>2^{40}</math> bytes = 1024 gigabytes</p>	

## ACE Examination 2014

## HSC Mathematics General 2 Yearly Examination

## Worked solutions and marking guidelines

Section 1		
	Solution	Criteria
1	12 scores. Median is the average of 14 and 18. Median is 16.	1 Mark: C
2	5 Litres in 1 min 1 kL (or 1000 Litres) in 200 min or 3 h 20 min	1 Mark: C
3	Height can take any numerical value. Continuous data	1 Mark: B
4	$SA = \frac{1}{2} \times 4\pi r^2 + \pi r^2 = 3\pi \times 5^2 = 235.619449... \approx 235.62 \text{ m}^2$	1 Mark: C
5	Amount paid = \$10000 + \$610 × 12 × 5 = \$46600 Saving = \$46600 - \$35000 = \$11600	1 Mark: D
6	$l = \sqrt{\frac{3V}{h}} = \sqrt{\frac{3 \times 652}{7.8}} = 15.8356948... \approx 15.8$	1 Mark: B
7	40, 45, 45, 55, 85, 90 Median 50, Mean 60	1 Mark: B
8	$\text{Area } \triangle ABD = \frac{1}{2} \times 40 \times 20$ $\text{Area } \triangle ADC = \frac{1}{2} \times 40 \times 10$ = 400     = 200 Total area is 600.	1 Mark: C
9	Map length = 650 ÷ 5000 = 0.13 m = 130 mm	1 Mark: C
10	$x = 2\sqrt{y}$ $\frac{x}{2} = \sqrt{y}$ or $y = \frac{x^2}{4}$	1 Mark: C
11	Total number = 31 + 69 + 29 + 76 = 205 $P(E) = \frac{29}{205}$	1 Mark: A
12	Data is more on the left side. The long tail is on the right. The distribution of the scores is positively skewed.	1 Mark: B
13	Fuel Consumption = $\frac{\text{Amount of fuel} \times 100}{\text{Distance travelled}} = \frac{48 \times 100}{640}$ = 7.5 L/100 km	1 Mark: B

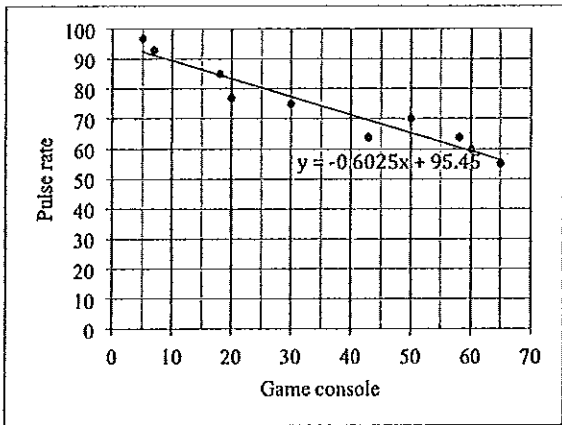
14	$t = \frac{k}{n}$ $t = \frac{64}{3}$ $16 = \frac{k}{4}$ = 21.3333...h $k = 64$ = 21 h 20 min	1 Mark: C
15	$y = 1 - 2x$ (Gradient of -2 and y-intercept 1) $= -2x + 1$	1 Mark: A
16	$V = \frac{h}{3}(A_1 + 4A_m + A_2)$ $= \frac{15}{3} \times (12 + 4 \times 16 + 14)$ $= 450 \text{ m}^3$	1 Mark: D
17	Longitude difference = $110^\circ + 150^\circ = 260^\circ$ Time difference = $260 \times 4 = 1040 \text{ min} = 17 \text{ h } 20 \text{ min}$ A is west of B. Subtract the time difference. A is 11.15 pm - 17 h 20 min = 5.55 am Monday	1 Mark: B
18	Let $x$ be the hours worked by Hannah. Abigail: $(x + 4 \times 2) \times \$20 = \$800$ $x + 8 = 40$ or $x = 32 \text{ h}$ Hannah: $32 \times \text{Wage rate} = \$800$ Wage rate = $\frac{\$800}{32} = \$25$	1 Mark: C
19	$A = \frac{1}{2}bh = \frac{1}{2} \times 10 \times 17$	1 Mark: B
20	$b = \bar{y} - m\bar{x}$ $= 60.44 - 0.90 \times 40.10$ $= 24.35$	1 Mark: B
21	$\frac{2000}{p} = \frac{1066}{5000}$ $1066p = 10\,000\,000$ $p = 9380.86303... \approx 9400$	1 Mark: D
22	16 GB = $16 \times 2^{10}$ MB = 16384 MB Number of files = $\frac{16384}{1.5} = 10922.6666... \approx 10923$	1 Mark: C
23	$P(E) = 1 - P(\text{No kittens})$ $= 1 - (0.2 \times 0.2) = 0.96$	1 Mark: D

24	To find angle (x) opposite 34. $\frac{\sin x^\circ}{34} = \frac{\sin 38^\circ}{22}$ $\sin x^\circ = \frac{34 \times \sin 38^\circ}{22}$ $x^\circ = 72.07809... \approx 72^\circ$ $\theta + 72^\circ + 38^\circ = 180^\circ$ $\theta = 70^\circ$	1 Mark: A
25	$V = 3r^2h + 9$ $V - 9 = 3r^2h$ $r^2 = \frac{V - 9}{3h}$	1 Mark: A

Section II		
	Solution	Criteria
26(a)(i)	$I = Prn$ $= \$15000 \times 0.075 \times 1$ $= \$1125$	1 Mark: Correct answer.
26(a)(ii)	Total interest charged $I = Prn$ $= \$15000 \times 0.075 \times 8 = \$9000$ Total repaid = $\$15000 + \$9000$ $= \$24000$	2 Marks: Correct answer. 1 Mark: Finds the total interest charged.
26(a)(iii)	Number of repayments = $8 \times 12 = 96$ Repayment = $\frac{\$24000}{96} = \$250$	1 Mark: Correct answer.
26(b)	$5y + 3(2 - y) = \frac{2y}{3} + 12$ $15y + 18 - 9y = 2y + 36$ $4y = 18$ $y = \frac{18}{4} = 4.5$	2 Marks: Correct answer. 1 Mark: Multiplies each term by 3 or shows some understanding.
26(c)(i)	$A = \frac{960}{n}$	1 Mark: Correct answer.
26(c)(ii)	$40 = \frac{960}{n}$ $40n = 960$ $n = \$24$	1 Mark: Correct answer.
26(c)(iii)	If tickets cost \$10, then there would have to be 96 people. Even a large bus does not seat many more than 60, so it would be impossible for him to sell tickets for \$10 without making a huge loss.	1 Mark: Correct answer.

26(d)	$D = \frac{kA}{70} = \frac{22.5 \times 12}{70} = 3.857... \approx 4 \text{ mL}$ Daily dosage = $3.857... \times 2 = 7.714... \approx 8 \text{ mL}$ Bottle lasts = $\frac{375}{8} = 46.875 \text{ d}$ The bottle of medicine will last about 46 days.	2 Marks: Correct answer. 1 Mark: Calculates the dosage for the child.
26(e)(i)	The car depreciates by \$5000 each year.	1 Mark: Correct answer.
26(e)(ii)	$S = V_0(1-r)^n$ $= \$45000 \times (1-0.15)^1$ $= \$38250$ $S = V_0(1-r)^n$ $= \$38250 \times (1-0.15)^1$ $= \$32512.50$	1 Mark: Correct answer.
26(e)(iii)	$S = V_0(1-r)^n$ $\$10000 = \$45000 \times (1-0.15)^n$ $\frac{\$10000}{\$45000} = 0.85^n$ $0.85^n = \frac{2}{9} = 0.22222222...$ Test different values $0.85^9 = 0.232...$ and $0.85^{10} = 0.197...$ Falls below \$10000 between 9 and 10 years.	2 Mark: Correct answers. 1 Mark: Substitutes correct values into the declining balance formula.
27(a)(i)	Ship A $s = \frac{d}{t}$ $25 = \frac{d}{5}$ $d = 125 \text{ km}$ Ship B $s = \frac{d}{t}$ $40 = \frac{d}{5}$ $d = 200 \text{ km}$	1 Mark: Correct answer.
27(a)(ii)	$\angle ACB = (360^\circ - 320^\circ) + 130^\circ$ $= 170^\circ$	1 Mark: Correct answer.
27(a)(iii)	$c^2 = a^2 + b^2 - 2ab \cos C$ $= 125^2 + 200^2 - 2 \times 125 \times 200 \times \cos 170^\circ$ $= 104865.3877...$ $c = 323.829256... \approx 324 \text{ km}$ Distance between the ships is 324 km at 4.00 pm.	2 Marks: Correct answer. 1 Mark: Uses cosine rule with at least one correct value.
27(b)(i)	$P(Y) = \frac{2}{20} \times \frac{1}{10}$	1 Mark: Correct answer.
27(b)(ii)	$P(YY) = \frac{2}{20} \times \frac{1}{19} = \frac{1}{190}$	1 Mark: Correct answer.
27(b)(iii)	$P(E) = \frac{2}{20} \times \frac{18}{19} + \frac{18}{20} \times \frac{2}{19} = \frac{18}{95}$	1 Mark: Correct answer.

27(c) (i)	Daily interest rate = $\frac{18.4\%}{365} = 0.050410958... \approx 0.0504\%$	1 Mark: Correct answer.
27(c) (ii)	Number of days is 18 {June: 1,2,3,4} {May: 18,19,20,21,22,23,24,25,26,27,28,29,30,31} $A = P(1+r)^n$ $= \$725(1 + \frac{0.184}{365})^{18}$ $= \$731.606895...$ $\approx \$731.60$ (nearest five cents)	2 Marks: Correct answer. 1 Mark: Finds the number of days or correctly uses the compound interest formula.
27(d) (i)	Diameter of semicircle = $5 - 1.25 - 1.25$ $= 2.5$ m $P = \pi \times 2.5 + 9 + 5 + 9 + 1.25 + 1.25$ $= 33.35398163...$ $\approx 33.35$ m Distance around the pool is 33.35 m.	2 Marks: Correct answer. 1 Mark: Finds the diameter of the semicircle or shows some understanding.
27(d) (ii)	$A = \frac{1}{2}\pi r^2 + lb$ $= \frac{1}{2} \times \pi \times 1.25^2 + 9 \times 5$ $= 47.45436926...$ $\approx 47.45$ m <sup>2</sup>	2 Marks: Correct answer. 1 Mark: Finds the area of the rectangle or the semicircle.
27(d) (iii)	$V = Ah$ $= 47.45436... \times 1.6$ $= 75.926990... \approx 76$ m <sup>3</sup>	1 Mark: Correct answer.
28(a) (i)	$z = \frac{x - \bar{x}}{s}$ $-2.5 = \frac{x - 9}{1.5}$ $-3.75 = x - 9$ $x = 5.25$ kg	1 Mark: Correct answer.
28(a) (ii)	Shaded section has a z-score between 0 and 1 (or 34%) 34% of 1200 = 408 packages	1 Mark: Correct answer.
28(a) (iii)	$z = \frac{x - \bar{x}}{s} = \frac{7.5 - 9}{1.5} = -1$ Percentage = $(100\% - 68\%) \div 2 = 16\%$	2 Marks: Correct answer. 1 Mark: Finds the z-score of 7.5 kg.
28(a) (iv)	$z = \frac{x - \bar{x}}{s} = \frac{15 - 9}{1.5} = 4$ A z-score of 4 indicates the chance of the Australian custom service receiving a package weighing 15 kg as very unlikely.	1 Mark: Correct answer.

28(b) (i)		2 Marks: Correct answer. 1 Mark: Draws the correct scatterplot or constructs an appropriate line of best fit.
28(b) (ii)	Accept answers close to $y = -0.6x + 95$	1 Mark: Correct answer.
28(b) (iii)	$r = -0.960874...$ $\approx -0.96$	1 Mark: Correct answer.
28(c) (i)	Jack: Range = $15.98 - 10.99 = 4.99$ s Ryan: Range = $14.66 - 11.27 = 3.39$ s Ryan has the smallest range of times.	1 Mark: Correct answer.
28(c) (ii)	Jack: Mean = $13.532857... \approx 13.5$ , $\sigma_n = 2.0071352... \approx 2.0$ Ryan: Mean = $12.917142... \approx 12.9$ $\sigma_n = 1.140447... \approx 1.1$	2 Mark: Correct answers. 1 Mark: Correct mean or standard deviation.
28(c) (iii)	Jack: IQR = $15.75 - 11.34 = 4.41$ s Ryan: IQR = $14.21 - 11.98 = 2.23$ s Jack has the largest interquartile range.	1 Mark: Correct answer.
28(c) (iv)	Jack's data is negatively skewed. The data is more on the right side and a long tail is on the left side.	1 Mark: Correct answer.
28(c) (v)	Ryan has a lower mean and a smaller range, standard deviation and interquartile range compared to Jack. Therefore Ryan is faster and more consistent runner than Jack.	1 Mark: Correct answer.
29(a) (i)	AE is the diameter of the circle. $AE = 2 \times 4$ $= 8$ cm	1 Mark: Correct answer.
29(a) (ii)	$\tan \angle ABE = \frac{8}{6}$ $\angle ABE = 53.13010235...$ $\approx 53^\circ$	1 Mark: Correct answer.



29(a) (iii)	Pythagoras theorem $AB^2 = 6^2 + 8^2 = 100$ $AB = 10$ cm	1 Mark: Correct answer.												
29(a) (iv)	$A = \frac{1}{2}\pi r^2 + \frac{1}{2}bh + s^2$ $= \frac{1}{2}\pi \times 4^2 + \frac{1}{2} \times 6 \times 8 + 10^2$ $= 149.1327412... \approx 149$ cm <sup>2</sup> Area of the aluminium is approximately 149 cm <sup>2</sup> .	2 Marks: Correct answer. 1 Mark: Finds the area of one shape.												
29(b) (i)	Number of arrangements = $16 \times 15 = 240$	1 Mark: Correct answer.												
29(b) (ii)	Number of selections = $\frac{14 \times 13 \times 12 \times 11}{4 \times 3 \times 2 \times 1}$ or ${}^{14}C_4 = 1001 = 1001$	1 Mark: Correct answer.												
29(c)	$A = \frac{h}{3}(d_f + 4d_n + d_l)$ $= \frac{30}{3}(20 + 4 \times 35 + 50) + \frac{30}{3}(50 + 4 \times 65 + 40)$ $= 5600$ m <sup>2</sup>	2 Marks: Correct answer. 1 Mark: Uses Simpsons with one correct value.												
29(d) (i)	<table border="1"> <tr> <td>v</td> <td>0</td> <td>20</td> <td>40</td> <td>60</td> <td>80</td> </tr> <tr> <td>d</td> <td>0</td> <td>3</td> <td>10</td> <td>21</td> <td>36</td> </tr> </table>	v	0	20	40	60	80	d	0	3	10	21	36	1 Mark: Correct answer.
v	0	20	40	60	80									
d	0	3	10	21	36									
29(d) (ii)		1 Mark: Correct answer.												
29(d) (iii)	Using the graph approximately 72 km/h.	1 Mark: Correct answer.												

29(e) (i)	Charge = $\$0.32 + (4 \times \$0.90) = \$3.92$	1 Mark: Correct answer.										
29(e) (ii)	Number of calls = $\frac{\$800}{(\$0.35 + \$0.88)} = 650.4065041... \approx 650$	1 Mark: Correct answer.										
29(e) (iii)	Monthly charge = $\$49 + 400 \times (\$0.32 + \$0.90) - \$500 = \$49 + \$488 - \$488$ (free calls \$500) = $\$49$	1 Mark: Correct answer.										
30(a) (i)	<table border="1"> <tr> <td>x</td> <td>0</td> <td>5</td> <td>10</td> <td>15</td> </tr> <tr> <td>A</td> <td>0</td> <td>1500</td> <td>1500</td> <td>0</td> </tr> </table>	x	0	5	10	15	A	0	1500	1500	0	2 Marks: Correct answer. 1 Mark: Two correct values in the table.
x	0	5	10	15								
A	0	1500	1500	0								
30(a) (ii)	$A = 0$ at $T$ The value of $T$ is 15.	1 Mark: Correct answer.										
30(a) (iii)	Maximum area occurs when $x = 7.5$ $A = 30x(15 - x)$ $= 30 \times 7.5 \times (15 - 7.5)$ $= 1687.5$ m <sup>2</sup> Maximum area of the yard is 1687.5 m <sup>2</sup> .	2 Marks: Correct answer. 1 Mark: Identifies that maximum area occurs when $x = 7.5$ .										
30(b) (i)	Angular distance = $16^\circ - 1^\circ = 15^\circ$ $l = \frac{\theta}{360} 2\pi r$ $= \frac{15}{360} \times 2 \times \pi \times 6400$ $= 1675.516082... \approx 1676$ km Distance travel is approximately 1676 km.	1 Mark: Correct answer.										
30(b) (ii)	$S = \frac{d}{t}$ $15 = \frac{1675.516082...}{t}$ $t = \frac{1675.516082...}{15}$ $= 111.70107$ $\approx 111$ h 42 min	1 Mark: Correct answer.										
30(b) (iii)	Nauru and Vanuatu have the same local time (both 167°E). 111 h 42 min = 4 d 15 h 42 min  Boat arrives Sunday 21 <sup>st</sup> August at 11.42 p.m.	2 Marks: Correct answer. 1 Mark: Identifies that Nauru and Vanuatu have the same local time.										

30(c)	$4x - y = 6$ (1) $3x + 2y = -1$ (2) Multiply eqn(1) by 2 $8x - 2y = 12$ (3) Add eqn (2) and eqn (3) $11x = 11$ $x = 1$ Substitute $x = 1$ into eqn (1) $4 \times 1 - y = 6$ $y = -2$ Solution is $x = 1$ and $y = -2$ (1, -2)	2 Marks: Correct answer. 1 Mark: Finds the correct value for $x$ or $y$ . Alternatively makes some significant progress towards the solution.
30(d) (i)	Principal for the second month is \$464 550	1 Mark: Correct answer.
30(d) (ii)	$\text{Amount owed} = \$467647 - \$3550$ $= \$464097$ Amount owed at the end of the second month is \$464 097.	1 Mark: Correct answer.
30(d) (iii)	$\text{Interest} = \$464097 \times \frac{0.08}{12}$ $= \$3093.98$	1 Mark: Correct answer.
30(d) (iv)	$\text{Amount owed} = \$464097 + \$3093.98 - \$3550$ $= \$463 640.98$ Amount owed at the end of the third month is \$463 640.98.	1 Mark: Correct answer.