ACE Examinations

Student Name: _____

Practice Paper 4
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

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1 Simplify $6x^2 + 2x + 4x^2$

    (A) $12x^2$

    (B) $12x^4$

    (C) $10x^2 + 2x$

    (D) $10x^4 + 2x$

2 Which of the following represents 0.5 terabytes using standard notation?

    (A) 0.55×10^{11} B

    (B) 0.55×10^{12} B

    (C) 5.5×10^{11} B

    (D) 5.5×10^{12} B

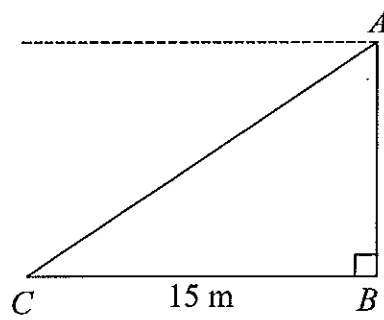**3** The line *l* has intercepts c and d, where c and d are integers.
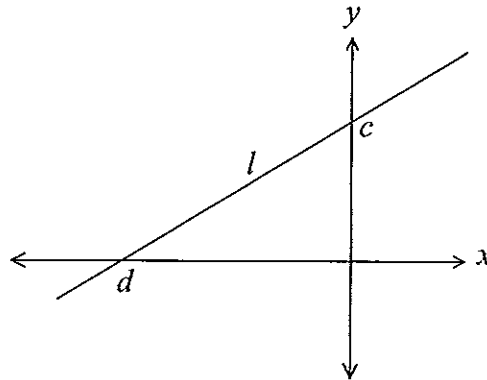
What is the gradient of line *l*?

    (A) $-\dfrac{c}{d}$

    (B) $-\dfrac{d}{c}$

    (C) $\dfrac{c}{d}$

    (D) $\dfrac{d}{c}$

4 Isaac buys 5 tickets in a raffle where 230 tickets were sold. He wins first prize. What is the probability that he also wins second prize?

(A) $\dfrac{1}{230}$

(B) $\dfrac{1}{46}$

(C) $\dfrac{2}{115}$

(D) $\dfrac{4}{229}$

**5** The angle of depression from A to C is 40°. The distance from B to C is 15 metres.

Not to scale

How high above B is A, to the nearest metre?

(A) 10 m

(B) 11 m

(C) 13 m

(D) 18 m

6 Jasmine purchased a used car for $7 500 and depreciated it by $700 each year. What is its depreciated value after three years?

(A) $4 700

(B) $5 400

(C) $6 100

(D) $6 800

7 Which of the following is a false statement?

(A) Population mean is denoted by $\bar{x}$

(B) Population is the entire data set.

(C) Sample is part of a population.

(D) Sample statistics are a measurable characteristic of a sample.

8 The box-and-whisker plot shows the assessment results of 160 students.
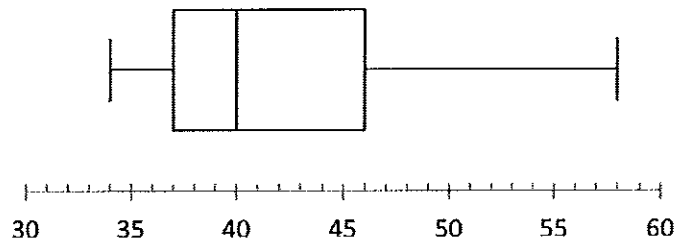
Which of the following statements is *false*?

(A) Data is negatively skewed.

(B) Median score is 40.

(C) 120 students achieved a score greater than the lower quartile.

(D) 40 students achieved a score greater than 46.

9 Adelaide is located at (35°N, 139°E) and Yokohama is located at (35°S, 139°E). What is the distance between Adelaide and Yokohama to the nearest kilometre? (Assume the radius of the earth is 6400 km).

(A) 559

(B) 3910

(C) 7819

(D) 15 526

10 There are four people sharing a house. Each person has a shower each day and uses 120 L of water per shower. Water costs $2.34 per kilolitre (kL). It is decided to install a water-efficient showerhead that uses 35% less water. How much could be saved on water costs each year?

(A) $41

(B) $143

(C) $266

(D) $410

11 What is the slope of the least-squares regression line given $r = 0.561$, $s_x = 1.987$ and $s_y = 4.579$?

(A) 0.24

(B) 1.29

(C) 7.13

(D) 16.21

12 In the diagram, O represents the centre of the earth, and Q lies on both the Equator and the Greenwich Meridian.


Not to scale
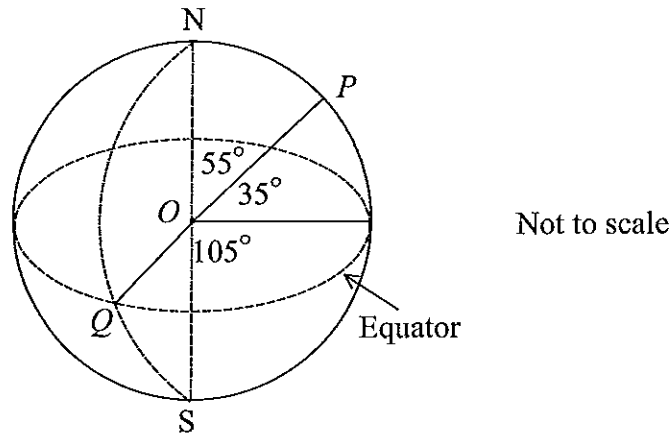
What is the latitude and longitude of point P?

(A) 35°N 105°E

(B) 35°N 105°W

(C) 55°N 105°E

(D) 55°N 105°W

13 A pair of players is to be selected from 7 people.
How many different pairs of players can be selected?

(A) 7

(B) 14

(C) 21

(D) 42

14 A 120 watt ceiling fan is run for 24 hours each day. If electricity is charged at 24.8 c/kWh, what is the cost of running the ceiling fan for 30 days, to the nearest cent?

(A) $15.68

(B) $21.43

(C) $86.40

(D) $2142.73

15 A computer was purchased for $2400 on 11 June 2013 using a credit card. Simple interest is charged at a rate of 18.75% per annum for purchases using a credit card. No other purchases were made and there was no interest-free period. The period for which interest was charged included the date of purchase and the date of payment.
What amount was required to pay the account in full on 19 July 2013?

(A) $2446.85

(B) $2447.20

(C) $2448.08

(D) $2449.32

16 Lachlan earns $81 500 in a year. His allowable deductions total $4 000. Using the table below, which of the following expressions represents his total tax payable?

Taxable income	*Tax payable*
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	$17 550 + 37 cents for each $1 over $80 000
$180 001 and over	$54 550 + 45 cents for each $1 over $180 000

    (A) $3572 + $40 500 × 0.325

    (B) $3572 + $44 500 × 0.325

    (C) $17 550 + $1 500 × 0.37

    (D) $17 550 + $5 500 × 0.37

17 What is the best description between living standards and life expectancy?

    (A)   Constant correlation

    (B)   Negative correlation.

    (C)   Positive correlation.

    (D)   Zero correlation.

18 What is the size of the smallest angle (θ) in the triangle below?

10 mm   18 mm   Not to scale

16 mm
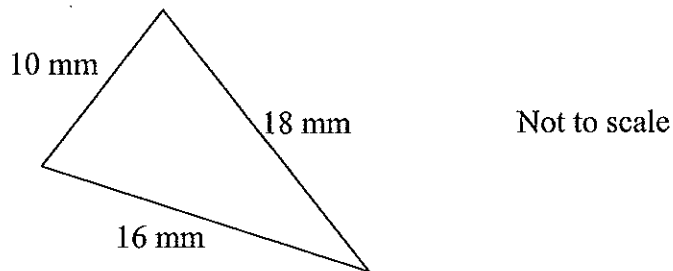
    (A) $\cos\theta = \dfrac{16^2 + 18^2 - 10^2}{2 \times 10 \times 16}$

    (B) $\cos\theta = \dfrac{10^2 + 18^2 - 16^2}{2 \times 10 \times 18}$

    (C) $\cos\theta = \dfrac{10^2 + 18^2 - 16^2}{2 \times 10 \times 16}$

    (D) $\cos\theta = \dfrac{16^2 + 18^2 - 10^2}{2 \times 16 \times 18}$

19 The monthly rainfall for Madison City is shown below.
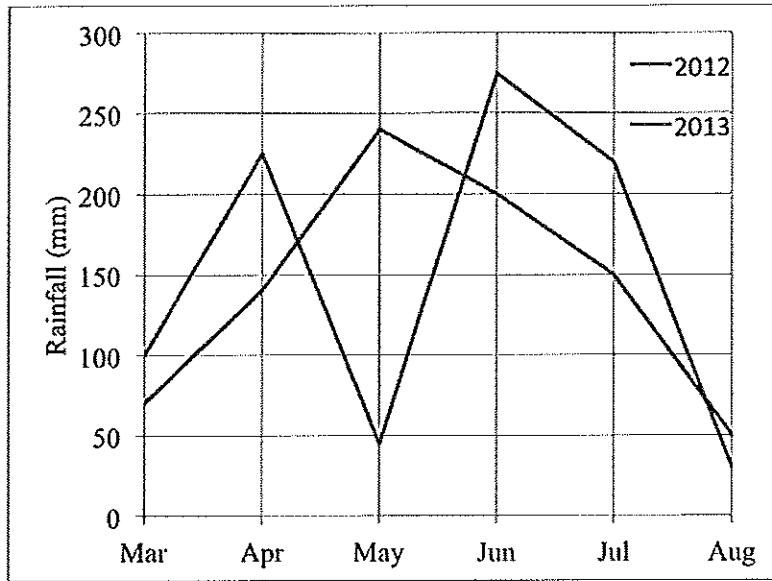
In which month was there the smallest difference in rainfall between 2012 and 2013?

(A) March   (B) May

(C) June   (D) August

20 A double radar chart is constructed with 12 sectors. What is the size of the angle in each sector?

(A) 10

(B) 18

(C) 30

(D) 36

21 Oscar buys a mobile phone for $800. He pays it off monthly over 3 years at an interest rate of 9.5% p.a. How much per month will he pay?

(A) $29

(B) $86

(C) $228

(D) $343

22 A factory produces bags of cashews. The weights of the bags are normally distributed, with a mean of 900 g and a standard deviation of 50 g. What is the best approximation for the percentage of bags that weigh more than 1000 g?

(A) 0%

(B) 2.5%

(C) 5%

(D) 16%

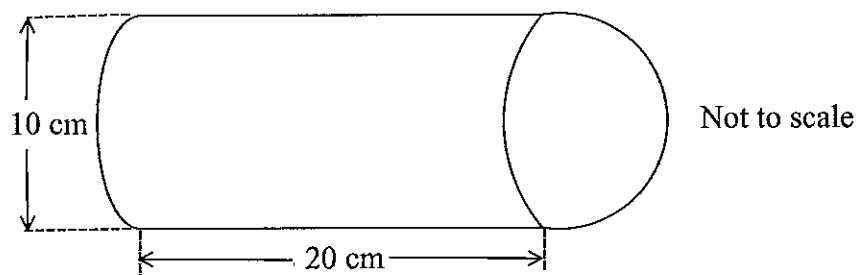**23** Which of the following correctly expresses c as the subject of $A = bc^2 + d$?

(A) $c = \pm\sqrt{\dfrac{A-d}{b}}$

(B) $c = \pm\dfrac{\sqrt{A-d}}{b}$

(C) $c = \pm\sqrt{\dfrac{A}{b} - d}$

(D) $c = \pm\sqrt{\dfrac{A}{b}} - d$

24 The solid shown is made of a cylinder with a hemisphere (half a sphere) on the right.

10 cm

20 cm

Not to scale

What is the total surface area of the solid, to the nearest square centimetre?

(A) 707 cm^2

(B) 785 cm^2

(C) 864 cm^2

(D) 942 cm^2

25 The speed (v), in km/h, of a ski lift is inversely proportional to the weight $(w \text{ kg})$ it carries. A ski lift carrying a weight of 320 kg can travel at 16 km/h. What is the speed of the ski lift if weight decreases to 250 kg?

(A) $\dfrac{16 \times 250}{320}$

(B) $\dfrac{16 \times 320}{250}$

(C) $\dfrac{250 \times 320}{16}$

(D) $\dfrac{320}{16 \times 250}$

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) Sophie borrowed $192 000 at an interest rate of 5.25% per annum compounded monthly. The repayments have been set at $900 per month.

Months (*n*)	Principal (*P*)	Interest (*I*)	Repayment	Balance
1	$192 000	$840	$900	
2			$900	

(i)   Explain why the interest charged for the first month is $840.   **1**

_____

_____

(ii) How much is owed at the end of the first month?   **1**

_____

_____

(iii) What is the interest charged for the second month? Answer to the nearest cent.   **2**

_____

_____

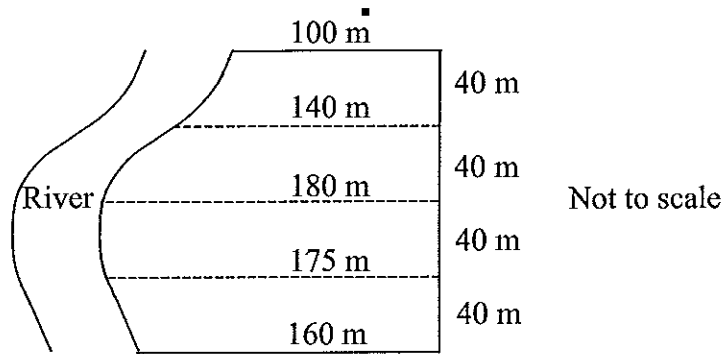(b) Simplify $(6xy^2)^3 \times (2x^4 y^6)^2$ **2**

_____

_____

_____

_____

9

(c)   A riverside campsite is shown below

100 m

40 m

140 m

40 m

River   180 m   Not to scale

40 m

175 m

40 m

160 m

Use two applications of Simpson's rule to approximate the area of the
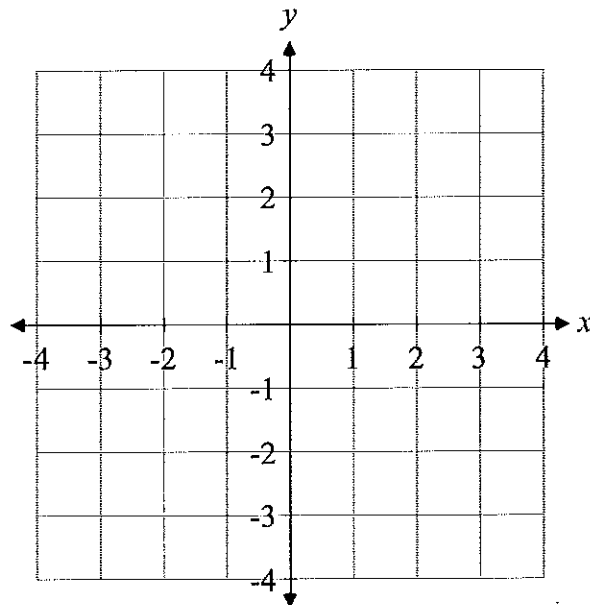campsite. Answer correct to the nearest square metre.   **2**

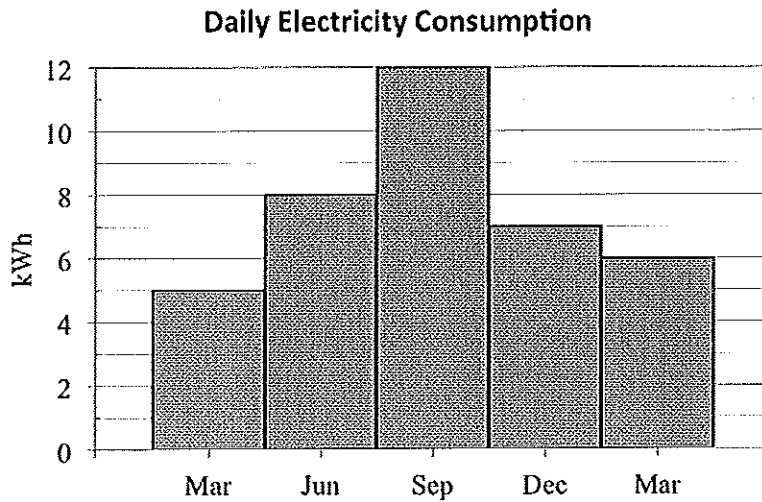(d)   Draw the graph of $y = -2x - 3$ and find the gradient and y-intercept.   **2**

10

(e) The graph is part of an electricity account issued to a customer.

Daily Electricity Consumption

(i) How many times per year is the electricity meter read?   **1**

_____

_____

(ii) In which quarter was the usage of the electricity least?   **1**

_____

_____

(iii) How much electricity did this household use per day in the June quarter?   **1**

_____

_____

(f) A credit card has a daily simple interest rate of 0.059% per day (no interest free period). Find the interest charged on $2210 for 14 days. Answer correct to the nearest cent.   **2**

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_____

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Question 27 (15 marks) **Marks**

(a) Alex is planning a trip to Toronto (44°N 79°W) from Sydney (34°S 151°E).

   (i) What is the difference in time between Toronto and Sydney? **1**

   _____

   _____

   (ii) Alex plans to leave Sydney at 6 am on a Sunday. What is the time in **1**
   Toronto when he leaves Sydney?
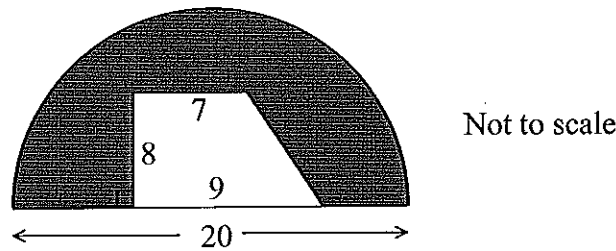
   _____

   _____

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(b) The diagram shows a semicircle, from which a trapezium has been cut. **3**
All measurements are in centimetres.

Not to scale

What is the area of the remaining shape, to the nearest square centimetre?

   _____

   _____

   _____

   _____

(c) Clark's rule $\left(\text{Dosage} = \dfrac{\text{Weight (kg)} \times \text{Adult dose}}{70} \right)$ is used to calculate dosages **2**
of medicine for children. What is the medication dose for Tyler, if he weighs
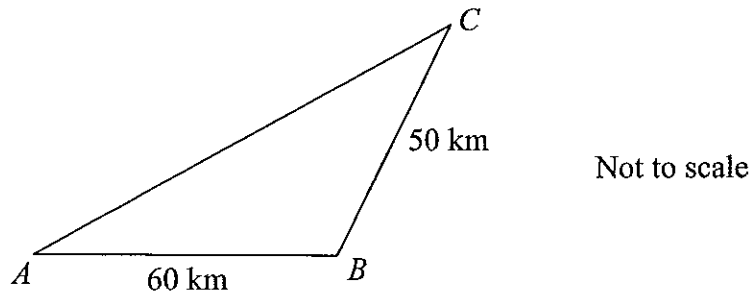28 kg and the adult dose is 15 mL?

   _____

   _____

   _____

   _____

12

(d) The diagram shows three towns. Town *A* is due west of town *B* and the bearing of town *C* from town *B* is 025°.

50 km

Not to scale

A   60 km   *B*

(i) What is the size of ∠*ABC*?   **1**

_____

_____

(ii) Find the distance (to nearest kilometre) from town *A* to town *C*.   **2**

_____

_____

_____

_____

(iii) What is the bearing of town *C* from town *A*?   **2**

_____

_____

_____

_____

(e) In a game two unbiased coins are tossed. A player outlays $30 and if both coins show tails the player is paid $48, if both coins show heads the player is paid $60.

(i) What is the probability of throwing two tails?   **1**

_____

_____

(ii) What is the expected return from $300 for this game?   **2**

_____

_____

Question 28 (15 marks)   **Marks**

(a) Solve the following equations:

   (i) $9x - 2 = -11$ **1**

   (ii) $2(a + 5) = 28$ **1**

   (iii) $\dfrac{4y}{3} + 3y - 5 = 0$ **1**

(b) A rain gauge registered 60 mm of rain during a storm. The rain fell on a shed with a rectangular roof that measures 25 metres by 10 metres.

   (i)   How many litres of water fell on the shed? Answer to the nearest litre   **2**

   (ii)   The water that fell on the shed was collected in an empty cylindrical tank with a diameter of 6 metres. What depth of water will be in the tank? Answer correct to two decimal places.   **2**
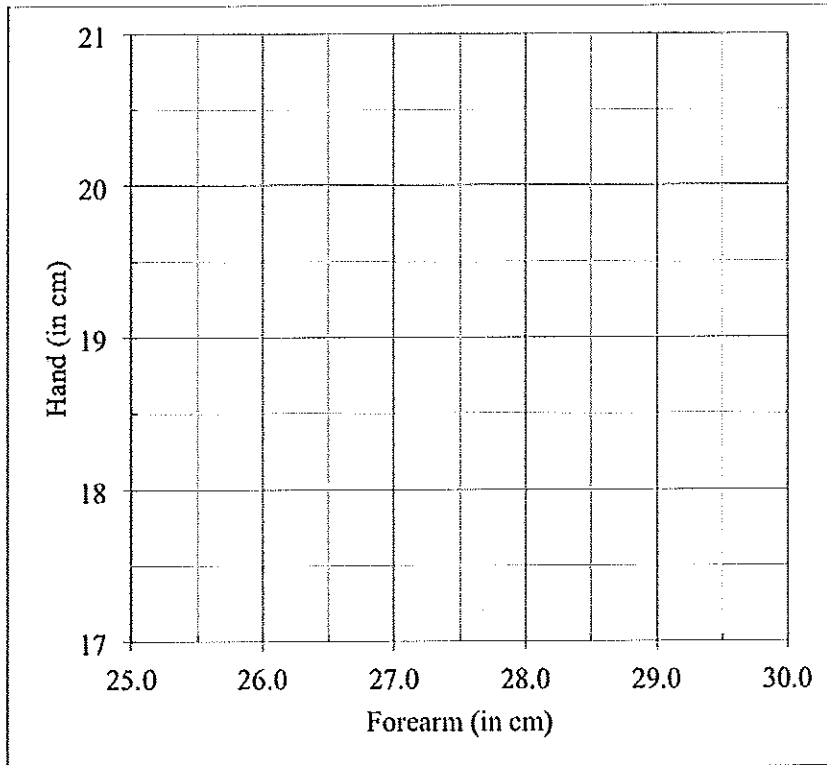
14

(c)   The table below shows forearm length and hand length.

Forearm (in cm)	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0	29.5
Hand (in cm)	17.3	17.6	18.2	18.4	19	19.4	19.8	20.1	20.4	20.6

(i)   Draw a scatterplot using the above table.   1

(ii)   Draw a line of best fit on the scatterplot.   1

(iii)   Describe the correlation between the forearm length and hand length.   1

_____

_____

(d)   Two cities lie on the same meridian of longitude and are 4356 km apart. One   2
city is located on the parallel of latitude of 47°N. What is the latitude of the
second city if it is south of the first city?

_____

_____

_____

_____

_____

(e) Nicholas borrows $204 000 over 7 years at an interest rate of 8.9% p.a. reducible. He pays $1776 per fortnight.

    (i)   How much will Nicholas pay back altogether?   **1**

    (ii)   What is the interest paid for this loan?   **1**

    (iii)   What is the equivalent flat interest rate charged per annum on this loan? Answer correct to 1 decimal place.   **1**

Question 29 (15 marks)   **Marks**

(a)   The table shows the present value interest factors for some monthly interest   **2**
      rates and loan periods in months.

Present value of $1				
Period	**0.0060**	**0.0065**	**0.0070**	**0.0075**
46	40.09350	39.64965	39.21263	38.78231
47	40.84841	40.38714	39.93310	39.48617
48	41.59882	41.11986	40.64856	40.18478
49	42.34475	41.84785	41.35905	40.87820

Hayley borrows $16 000 for a car. She arranges to repay the loan with
monthly repayments over 4 years. She is charged 8.4% per annum interest.
Using the table, calculate the amount of interest Hayley will pay over the
term of the loan

_____

_____

_____

_____

_____

_____

_____

(b)   The capture-recapture technique was used to estimate the population of   **2**
      penguins in 2013.

- 50 penguins were caught, tagged and released.
- Later, 110 penguins were caught at random.
- 20 of these 110 penguins had been tagged.

The estimated population of the penguins in 2013 was 13% less than the
estimated population for 2012.

What was the estimated population for 2012?

_____

_____

_____

_____

_____

(c) (i)   In a class test Charlie has a z-score of 2. What does that mean?   **1**

_____

_____

_____

(ii)   The mean for the test is 64% and the standard deviation is 12.5.   **1**
Hannah obtains a z-score of –2. What is her mark?

_____

_____

_____

(iii)   Jacob has a mark of 51.5%. What is his z-score?   **1**

_____

_____

_____

(iv)   Lucy said she had a z-score of 3 but Hannah is unconvinced. Why?   **1**

_____

_____

_____

(d)   On a biased coin, the probability of throwing a head is 60%. The coin is   **2**
tossed twice. What is the probability of at least one head being tossed?

_____

_____

_____

(e)   Jack has a mobile phone contract that charges a monthly access fee of $79,   **1**
free calls $250, flagfall $0.35 and call rate of $0.45 per 30 second. What is
the monthly charge if Jack made 300 calls whose duration was less than 30
seconds?

_____

_____

_____

(f) Solve the following pair of simultaneous equations. **2**

$$2x - 3y = -1$$
$$x + 2y = 10$$

(g) Life expectancy and gym memberships have both risen strongly in the last **2**
decade. Is this strong relationship between the two correlational or causal?

Question 30 (15 marks)   **Marks**

(a)   Ethan surveyed his friends to check the number of text messages received on a given day. The number of messages found were 18, 3, 17, 24, 37, 1, 23, 16, 19, 8, 5, 11, 10, 17, 4, 19, 30, 18, 30, 25, 6, 28, 24, 9, 10, 22 and 12.

(i)   Complete the grouped frequency table.   **1**

Class	Class Centre	Frequency	Cumulative Frequency
0–9			
10–19			
20–29			
30–39			

(ii)   How many friends were surveyed?   **1**

(iii)   What is the modal class?   **1**

(iv)   What is the mean number of text messages? Answer correct to one decimal place.   **1**

(v)   Find the population standard deviation. Answer correct to one decimal place.   **1**

(vi)   What percentage of friends had less that 10 text messages received on a given day? Answer correct to the nearest percentage.   **1**

(b) Lucas's watering can is initially filled with 4 litres of water. However the watering can has a small hole in the base and is leaking at a rate of 0.2 litres per minute.

    (i)   Write a linear equation in the form $V = mt + b$ to describe this situation.   **1**

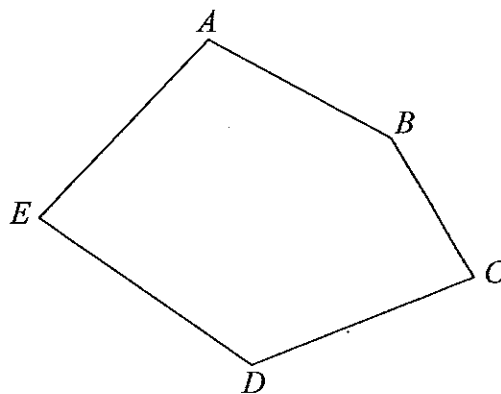   (ii)   What volume of water remains after 150 seconds?   **1**

    (iii)   How long would it take for all the water to leak out?   **1**

(c) Harry is constructing a plane table radial survey of the field *ABCDE*.   **2**

Harry starts with the following steps.
1. Table and large sheet of paper are placed in the centre of the field.
2. A point *P* is marked on the paper roughly near the centre.

Describe how Harry would complete the survey.

(d)   A tennis competition involves every player having a match against every other player. The number of matches is calculated using the formula:
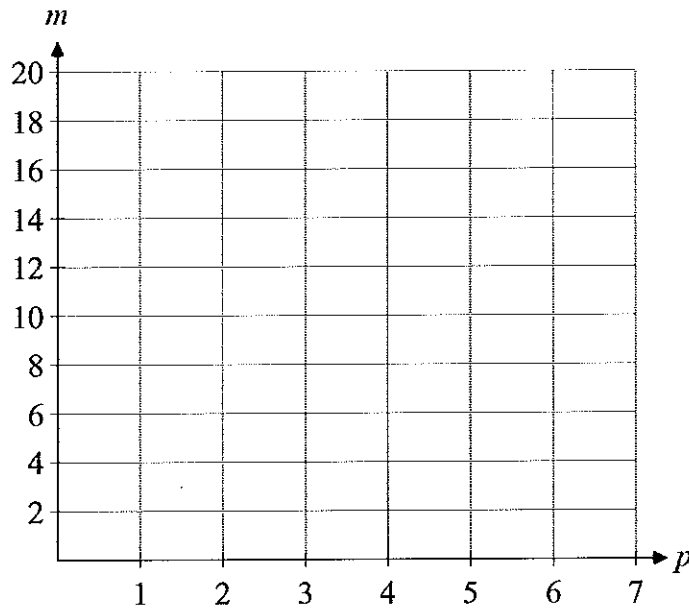
$$m = \frac{1}{2}\left(p^2 - p\right)$$

where m is the number of matches and p the number of players.

(i)   Complete the table of values for the above formula.   **1**

m	1	2	3	4	5	6
p						

(ii)   Plot the points from the table of values. Join the points.   **1**

(iii)   Use the model to predict the number of matches for 7 players.   **1**

_____

_____

(iv)   Explain why you would not use the model when p is less than one.   **1**
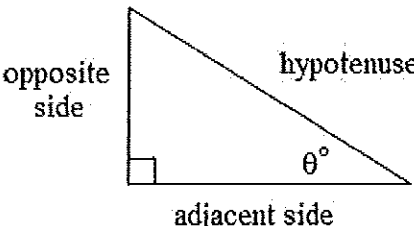
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End of paper

FORMULAE AND DATA SHEET

Financial Mathematics

Simple interest

$$I = Prn$$

P is initial amount

r is interest rate per period, expressed as a decimal

n is number of periods

Compound interest

$$A = P(1+r)^n$$

A is final amount

P is initial amount

r is interest rate per period, expressed as a decimal

n is number of compounding periods

Present value and future value

$$PV = \frac{FV}{(1+r)^n}, \quad FV = PV(1+r)^n$$

r is interest rate per period, as expressed as a decimal

n is number of compounding periods

Straight-line method of depreciation

$$S = V_0 - Dn$$

S is salvage value of asset after n periods

V_0 is initial value of asset

D is amount of depreciation per period

n is number of periods

Declining-balance method of depreciation

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

S is salvage value of asset after n periods

V_0 is initial value of asset

r is depreciation rate per period, expressed as a decimal

n is number of periods

Data Analysis

Mean of a sample

$$\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$$

z-score

For any score x,

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

x is mean

s is standard deviation

Outlier(s)

score(s) less than $Q_L - 1.5 \times IQR$ or

score(s) more than $Q_U + 1.5 \times IQR$

Q_L is lower quartile

Q_U is upper quartile

IQR is interquartile range

Least-squares line of best fit

$$y = \text{gradient} \times x + y\text{-intercept}$$

$$\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$$

$$y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$$

r is correlation coefficient

$\bar{x}$ is mean of x score

$\bar{y}$ is mean of y scores

Normal distribution

- pproximately 68% of scores have z-scores between −1 and 1

- pproximately 95% of scores have z-scores between −2 and 2

- pproximately 99.7% of scores have z-scores between −3 and 3

Spherical Geometry

Circumference of a circle

$$C = 2\pi r \text{ or } C = \pi d$$

r is radius

d is diameter

Arc length of a circle

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

r is radius

θ is number of degrees in central angle

Radius of Earth

(taken as) 6400 km

Time differences

For calculation of time differences using longitude: $15° = 1$ hour time difference

Area

Circle

$$A = \pi r^2$$

r is radius

Sector

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

r is radius

θ is number of degrees in central angle

Annulus

$$A = \pi(R^2 - r^2)$$

R is radius of outer circle

r is radius of inner circle

Trapezium

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

h is perpendicular height

a and b are the lengths of the parallel sides

Area of land and catchment areas

unit conversion: 1 ha = 10 000 m^2

Surface Area

Sphere

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

r is radius

Closed cylinder

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

r is radius

h is perpendicular height

Volume

Prism or cylinder

$$V = Ah$$

r is radius

h is perpendicular height

Pyramid or cone

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

A is area of the base

h is perpendicular height

Volume and capacity

unit conversion: 1 m^3 = 1000 L

Approximation Using Simpson's Rule

Area

$$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$$

h distance between successive measurements

d_f is first measurement

d_m is middle measurement

d_l is last measurement

Volume

$$V \approx \frac{h}{3}(A_L + 4A_m + A_R)$$

h distance between successive measurements

A_L is area of left end

A_M is area of middle

A_R is area of right end

Trigonometric Ratios

$$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine rule

In $\triangle ABC$

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

Cosine rule

In $\triangle ABC$

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

or

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

Units of Memory and File Size

1 byte = 8 bits

1 kilobyte = 2^{10} bytes = 1024 bytes

1 megabyte = 2^{20} bytes = 1024 kilobytes

1 gigabyte = 2^{30} bytes = 1024 megabytes

1 terabyte = 2^{40} bytes = 1024 gigabytes

Blood Alcohol Content Estimates

$$BAC_{Male} = \frac{(10N - 7.5H)}{6.8M} \quad \text{or}$$

$$BAC_{Female} = \frac{(10N - 7.5H)}{5.5M}$$

N is number of standard drinks consumed

H is number of hours of drinking

M is person's mass in kilograms

Distance, Speed and Time

$$D = ST, \ S = \frac{D}{T}, \ T = \frac{D}{S}$$

$$\text{average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$\text{stopping distance} = \left\{\begin{array}{c}\text{reaction-time}\\ \text{distance}\end{array}\right\} + \left\{\begin{array}{c}\text{braking}\\ \text{distance}\end{array}\right\}$$

Probability of an Event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Straight Lines

Gradient

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient–intercept form

$$y = mx + b$$

m is gradient

b is y-intercept

ACE Examination 2014

HSC Mathematics General 2 Yearly Examination

Worked solutions and marking guidelines

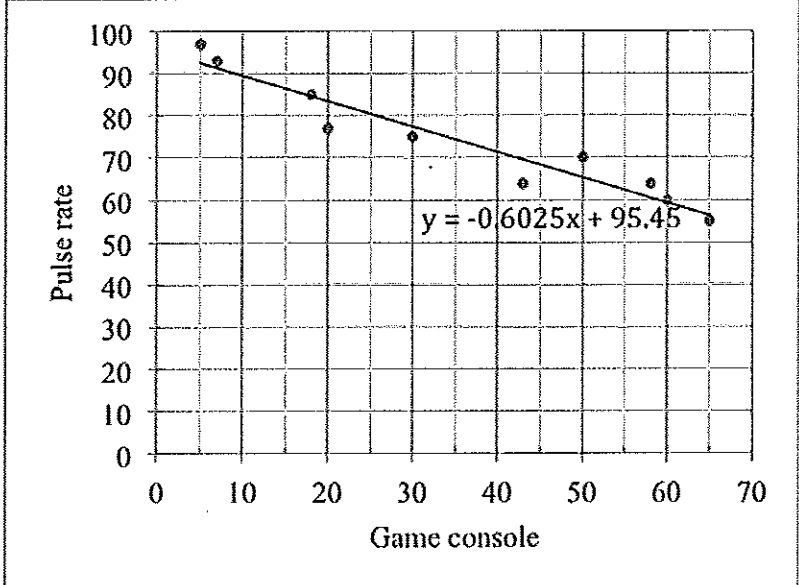| Section 1		
	Solution	**Criteria**
1	12 scores. Median is the average of 14 and 18. Median is 16.	1 Mark: C
2	5 Litres in 1 min 1 kL (or 1000 Litres) in 200 min or 3 h 20 min	1 Mark: C
3	Height can take any numerical value. Continuous data	1 Mark: B
4	$SA = \dfrac{1}{2} \times 4\pi r^2 + \pi r^2 =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

14	$t = \dfrac{k}{n}$ $16 = \dfrac{k}{4}$ $k = 64$	$t = \dfrac{64}{3}$ $= 21.3333...$ h $= 21$ h 20 min	1 Mark: C
15	$y = 1 - 2x$ (Gradient of -2 and y-intercept 1) $= -2x + 1$		1 Mark: A
16	$V = \dfrac{h}{3}(A_f + 4A_m + A_l)$ $= \dfrac{15}{3} \times (12 + 4 \times 16 + 14)$ $= 450$ m^3		1 Mark: D
17	Longitude difference $= 110° + 150° = 260°$ Time difference $= 260 \times 4 = 1040$ min $= 17$ h 20 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: $(x + 4 \times 2) \times \$20 = \$800$ $\qquad\qquad\qquad x + 8 = 40$ or $x = 32$ h Hannah: $32 \times$ Wage rate $= \$800$ $\qquad\qquad$ Wage rate $= \dfrac{\$800}{32} = \$25$		1 Mark: C
19	$A = \dfrac{1}{2}bh = \dfrac{1}{2} \times 10 \times 17$		1 Mark: B
20	$b = \bar{y} - m\bar{x}$ $= 60.44 - 0.90 \times 40.10$ $= 24.35$		1 Mark: B
21	$\dfrac{2000}{p} = \dfrac{1066}{5000}$ $1066p = 10\ 000\ 000$ $p = 9380.86303... \approx 9400$		1 Mark: D
22	16 GB $= 16 \times 2^{10}$ MB $= 16384$ MB Number of files $= \dfrac{16384}{1.5} = 10922.6666... \approx 10923$		1 Mark: C
23	$P(E) = 1 - P(\text{No kittens})$ $= 1 - (0.2 \times 0.2) = 0.96$		1 Mark: D

2

24	To find angle (x) opposite 34. $\dfrac{\sin x°}{34} = \dfrac{\sin 38°}{22}$ $\sin x° = \dfrac{34 \times \sin 38°}{22}$ $x° = 72.07809... \approx 72°$	$\theta + 72° + 38° = 180°$ $\theta = 70°$	1 Mark: A
25	$V = 3r^2h + 9$ $V - 9 = 3r^2h$ $r^2 = \dfrac{V-9}{3h}$		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 $\quad I = Prn$ $\qquad\qquad\qquad = \$15000 \times 0.075 \times 8 = \$9000$ Total repaid $= \$15000 + \$9000$ $\qquad\qquad\quad = \$24000$	2 Marks: Correct answer. 1 Mark: Finds the total interest charged.
26(a) (iii)	Number of repayments $= 8 \times 12 = 96$ Repayment $= \dfrac{\$24000}{96} = \$250$	1 Mark: Correct answer.
26(b)	$5y + 3(2-y) = \dfrac{2y}{3} + 12$ $15y + 18 - 9y = 2y + 36$ $\qquad\quad 4y = 18$ $\qquad\quad y = \dfrac{18}{4} = 4.5$	2 Marks: Correct answer. 1 Mark: Multiplies each term by 3 or shows some understanding.
26(c) (i)	$A = \dfrac{960}{n}$	1 Mark: Correct answer.
26(c) (ii)	$40 = \dfrac{960}{n}$ $40n = 960$ $n = \$24$	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)	$D = \dfrac{kA}{70} = \dfrac{22.5 \times 12}{70} = 3.857... \approx 4 \text{ mL}$ Daily dosage $= 3.857... \times 2 = 7.714... \approx 8 \text{ mL}$ Bottle lasts $= \dfrac{375}{8} = 46.875 \text{ d}$ 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)	$S = V_0(1-r)^n$ $S = V_0(1-r)^n$ $\quad = \$45000 \times (1-0.15)^1$ $\quad = \$38250 \times (1-0.15)^1$ $\quad = \$38250$ $\quad = \$32512.50$	1 Mark: Correct answer.
26(e) (iii)	$S = V_0(1-r)^n$ $\$10000 = \$45000 \times (1-0.15)^n$ $\dfrac{\$10000}{\$45000} = 0.85^n$ $0.85^n = \dfrac{2}{9} = 0.22222222...$ 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 $s = \dfrac{d}{t}$ Ship B $s = \dfrac{d}{t}$ $\quad 25 = \dfrac{d}{5}$ $40 = \dfrac{d}{5}$ $\quad d = 125 \text{ km}$ $d = 200 \text{ km}$	1 Mark: Correct answer.
27(a) (ii)	$\angle ACB = (360° - 320°) + 130°$ $\quad\quad\quad = 170°$	1 Mark: Correct answer.
27(a) (iii)	$c^2 = a^2 + b^2 - 2ab\cos C$ $\quad = 125^2 + 200^2 - 2 \times 125 \times 200 \times \cos 170°$ $\quad = 104865.3877...$ $c = 323.829256... \approx 324 \text{ km}$ 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)	$P(Y) = \dfrac{2}{20} = \dfrac{1}{10}$	1 Mark: Correct answer.
27(b) (ii)	$P(YY) = \dfrac{2}{20} \times \dfrac{1}{19} = \dfrac{1}{190}$	1 Mark: Correct answer.
27(b) (iii)	$P(E) = \dfrac{2}{20} \times \dfrac{18}{19} + \dfrac{18}{20} \times \dfrac{2}{19} = \dfrac{18}{95}$	1 Mark: Correct answer.

27(c) (i)	Daily interest rate $= \dfrac{18.4\%}{365} = 0.050410958... \approx 0.0504\%$	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} $A = P(1+r)^n$ $= \$725(1+\dfrac{0.184}{365})^{18}$ $= \$731.606895...$ $\approx \$731.60$ (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 $= 5-1.25-1.25$ $\qquad\qquad\qquad\quad = 2.5$ m $P = \pi \times 2.5 + 9 + 5 + 9 + 1.25 + 1.25$ $\quad = 33.35398163...$ $\quad \approx 33.35$ 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)	$A = \dfrac{1}{2}\pi r^2 + lb$ $\quad = \dfrac{1}{2} \times \pi \times 1.25^2 + 9 \times 5$ $\quad = 47.45436926...$ $\quad \approx 47.45$ m^2	2 Marks: Correct answer. 1 Mark: Finds the area of the rectangle or the semicircle.
27(d) (iii)	$V = Ah$ $\quad = 47.45436... \times 1.6$ $\quad = 75.926990... \approx 76$ m^3	1 Mark: Correct answer.
28(a) (i)	$z = \dfrac{x-\bar{x}}{s}$ $-2.5 = \dfrac{x-9}{1.5}$ $-3.75 = x-9$ $\quad x = 5.25$ 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)	$z = \dfrac{x-\bar{x}}{s} = \dfrac{7.5-9}{1.5} = -1$ Percentage $= (100\% - 68\%) \div 2 = 16\%$	2 Marks: Correct answer. 1 Mark: Finds the z-score of 7.5 kg.
28(a) (iv)	$z = \dfrac{x-\bar{x}}{s} = \dfrac{15-9}{1.5} = 4$ 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)	$r = -0.960874...$ ≈ -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)	$\tan \angle ABE = \dfrac{8}{6}$ $\angle ABE = 53.13010235...$ $\approx 53°$	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)	$A = \dfrac{1}{2}\pi r^2 + \dfrac{1}{2}bh + s^2$ $= \dfrac{1}{2} \times \pi \times 4^2 + \dfrac{1}{2} \times 6 \times 8 + 10^2$ $= 149.1327412... \approx 149$ cm^2 Area of the aluminium is approximately 149 cm^2.	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 $= \dfrac{14 \times 13 \times 12 \times 11}{4 \times 3 \times 2 \times 1}$ or $^{14}C_4 = 1001$ $= 1001$	1 Mark: Correct answer.
29(c)	$A = \dfrac{h}{3}(d_f + 4d_m + d_l)$ $= \dfrac{30}{3}(20 + 4 \times 35 + 50) + \dfrac{30}{3}(50 + 4 \times 65 + 40)$ $= 5600$ m^2	2 Marks: Correct answer. 1 Mark: Uses Simpsons with one correct value.
29(d) (i)	<table><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>	1 Mark: Correct answer.
29(d) (ii)		1 Mark: Correct answer.
29(d) (iii)	Using the graph approximately 72 km/h.	1 Mark: Correct answer.

7

29(e) (i)	Charge $= \$0.32 + (4 \times \$0.90)$ $\qquad = \$3.92$	1 Mark: Correct answer.
29(e) (ii)	Number of calls $= \dfrac{\$800}{(\$0.35 + \$0.88)}$ $\qquad = 650.4065041... \approx 650$	1 Mark: Correct answer.
29(e) (iii)	Monthly charge $= \$49 + 400 \times (\$0.32 + \$0.90) - \$500$ $\qquad = \$49 + \$488 - \$488$ (free calls \$500) $\qquad = \$49$	1 Mark: Correct answer.
30(a) (i)	<table><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>	2 Marks: Correct answer. 1 Mark: Two correct values in the table.
30(a) (ii)	$A = 0$ at T The value of T is 15.	1 Mark: Correct answer.
30(a) (iii)	Maximum area occurs when $x = 7.5$ $A = 30x(15 - x)$ $\quad = 30 \times 7.5 \times (15 - 7.5)$ $\quad = 1687.5 \text{ m}^2$ Maximum area of the yard is 1687.5 m^2.	2 Marks: Correct answer. 1 Mark: Identifies that maximum area occurs when $x = 7.5$.
30(b) (i)	Angular distance $= 16° - 1° = 15°$ $l = \dfrac{\theta}{360}2\pi r$ $\quad = \dfrac{15}{360} \times 2 \times \pi \times 6400$ $\quad = 1675.516082... \approx 1676 \text{ km}$ Distance travel is approximately 1676 km.	1 Mark: Correct answer.
30(b) (ii)	$S = \dfrac{d}{t}$ $15 = \dfrac{1675.516082...}{t}$ $t = \dfrac{1675.516082...}{15}$ $\quad = 111.70107$ $\quad \approx 111 \text{ h } 42 \text{ min}$	1 Mark: Correct answer.
30(b) (iii)	Nauru and Vanuatu have the same local time (both 167°E). $111 \text{ h } 42 \text{ min} = 4 \text{ d } 15 \text{ h } 42 \text{ min}$ Boat arrives Sunday 21st 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)	Amount owed = $467647 - $3550 $\qquad\qquad = 464097 Amount owed at the end of the second month is $464 097.	1 Mark: Correct answer.
30(d) (iii)	Interest $= $464097 \times \dfrac{0.08}{12}$ $\qquad = 3093.98	1 Mark: Correct answer.
30(d) (iv)	Amount owed = $464097 + $3093.98 - $3550 $\qquad\qquad = $463\ 640.98$ Amount owed at the end of the third month is $463 640.98.	1 Mark: Correct answer.