2015

YEAR 12

TRIAL EXAMINATION

Student Name: _____

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
- In Questions 26-30, show relevant mathematical reasoning and/or calculations

Total marks - 100

Section I

25 marks

- Attempt Questions 1-25
- Use Multiple Choice answer sheet provided
- Allow about 35 minutes for this section

Section II

75 marks

- Attempt Questions 26-30
- Answer the questions in the spaces provided
- 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 Which of the following is *not* equal to $12a^3b^2$?

(A) $5a^3b^2 + 7a^3b^2$

(B) $3a^2b \times 4ab$

(C) $\dfrac{24a^5b^2}{2a^2b}$

(D) $24a^3b^2 - 12a^3b^2$

2 The length of a child's foot increases until they reach adulthood. What is the best description for the relationship between foot length and a child's age?

(A) Positive correlation

(B) Negative correlation

(C) Extrapolation

(D) Interpolation

3 The isosceles ΔABC has two equal side lengths of 12 cm and a base length of 20 cm. What is the length of *AD*?

Not to scale
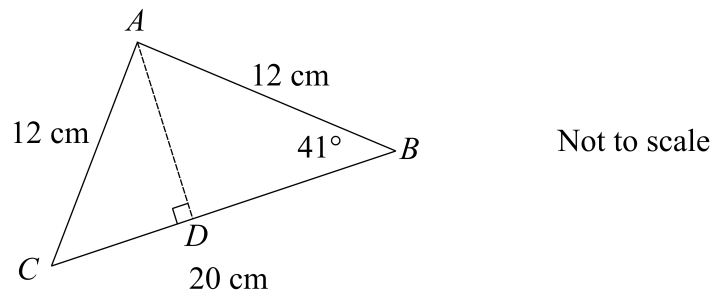
(A) $12 \times \cos 41$

(B) $12 \times \sin 41$

(C) $\dfrac{20 \times \sin 41}{\sin 49}$

(D) $20 \times \tan 41$

4 In a particular week, Zara works the number of hours shown in the table.

Hours worked			
Employee	Normal hours	Hours $\times$ 1.5	Gross wage
Zara Harrison	29	8	$697

According to the information in the table, what was the hourly rate of pay for Zara?

(A) $17.00

(B) $18.84

(C) $21.12

(D) $24.03

5 Jessica has 18 red discs and 2 blue discs in a bag. What is the probability that two discs randomly selected from the bag will be blue discs?

(A) $\dfrac{1}{190}$

(B) $\dfrac{1}{153}$

(C) $\dfrac{1}{10}$

(D) $\dfrac{1}{9}$

6 The water usage charge for non-residential property is $1.80/kL for the first 250 kL and $2.20/kL for any consumption over 250 kL.

What is the cost if the amount of water consumed is 480 kL?

(A) $864

(B) $956

(C) $1056

(D) $1506

7 Which one of the following is a hyperbolic function?

(A) $y = \dfrac{2}{x}$

(B) $y = \left(\dfrac{1}{2}\right)^x$

(C) $y = 2x^3$

(D) $y = 2^x$

8 The table below shows the monthly repayments per $1000 on a home loan.

Term of loan	6.00%	6.25%	6.50%	6.75%	7.00%	7.25%
5	$19.33	$19.45	$19.57	$19.68	$19.80	$19.93
10	$11.10	$11.23	$11.35	$11.48	$11.62	$11.86
15	$8.44	$8.57	$8.71	$8.85	$8.99	$9.13
20	$17.16	$7.31	$7.46	$7.60	$7.84	$7.99

What is the monthly repayment for a loan of $84 000 at 6.75% p.a. interest over 10 years?

(A) $11.48

(B) $96.43

(C) $964.32

(D) $11 480.00

9 The following triangle has sides 44 cm, 65 cm and 72 cm.
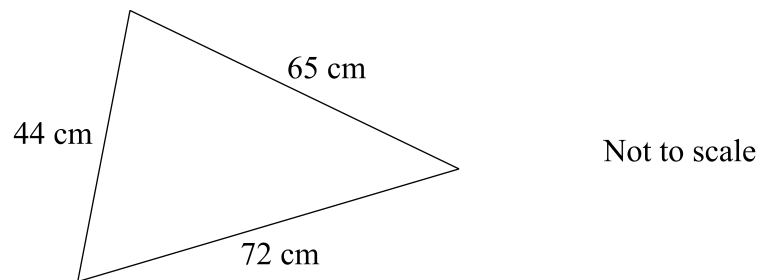
Angle *C* is the largest angle. Which of the following expressions is correct for angle *C*?

(A) $\cos C = \dfrac{44^2 + 72^2 - 65^2}{2 \times 44 \times 72}$

(B) $\cos C = \dfrac{65^2 + 44^2 - 72^2}{2 \times 65 \times 44}$

(C) $\cos C = \dfrac{65^2 + 72^2 - 44^2}{2 \times 65 \times 72}$

(D) $\cos C = \dfrac{65^2 + 44^2 - 72^2}{2 \times 65 \times 72}$

10 Harry's solution to the equation $3y + 5 = 5(y-1)$ is shown below.

$3y + 5 = 5(y-1)$

$3y + 5 = 5y - 1$ Line1

$-2y + 5 = -1$ Line2

$-2y = 4$ Line3

$y = -2$ Line4

Where is the error in Harry's working?

(A) Line 1 and line 2

(B) Line 1 and line 3

(C) Line 2 and line 3

(D) Line 2 and line 4

11 Charlie borrows $60 000 for a luxury motor vehicle. Interest is calculated at a flat rate of 9.75% p.a. After one month he makes his first repayment of $1 312.50.
How much does he owe after one month?

(A) $58 687.50

(B) $59 175.00

(C) $58 231.00

(D) $59 343.50

12 Jessica received 1.8 L of fluid over 12 h. What is the flow rate in mL/h?

(A) 6.6 mL/h

(B) 15 mL/h

(C) 21.6 mL/h

(D) 150 mL/h

13 There are five times as many cars registered in Australia as trucks. Let C stand for the number of cars and T for the number of trucks. Which equation correctly describes the relationship between the number of cars and the number of trucks?

(A) $C = 5T$

(B) $C = \dfrac{5}{T}$

(C) $T = 5 + C$

(D) $T = 5C$

14 Thomas earns $39 640 in a year. His allowable deductions total $3 240.

| *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

Using the table above, which of the following expressions represents his tax payable?

(A)   Nil + $18 200 × 0.19

(B)   Nil + $36 400 × 0.19

(C) $3572 + $2 640 × 0.325

(D) $3572 + $5 880 × 0.325

15 The time T (in seconds) for a single swing of the pendulum in a clock is given by the formula: $T = \sqrt{\dfrac{L}{9.8}}$ where L is the length of the pendulum. It takes 3 seconds for a single swing of the pendulum. What is the length of the pendulum?

(A) $3 \times \sqrt{9.8}$

(B) 3×9.8^2

(C) 9×9.8

(D) 9×9.8^2

16 Calculate the surface area of this triangular prism?
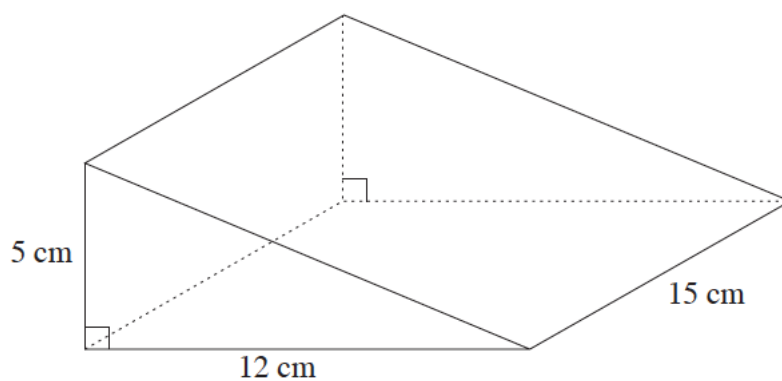
(A)   450 cm^2

(B)   510 cm^2

(C)   540 cm^2

(D)   570 cm^2

17 Isaac invested $35 000 at a rate of 4.8% per annum compounded every 6 months. How much interest dis Isaac earn on his investment over 5 years?

(A) $35 000(1.024)^5 - $35 000

(B) $35 000(1.024)^{10} - $35 000

(C) $35 000(1.048)^5 - $35 000

(D) $35 000(1.048)^{10} - $35 000

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

$h = 15$ m, $A_f = 22$ m, $A_m = 25$ m and $A_l = 23$ m.

(A) 48 m^3

(B) 350 m^3

(C) 725 m^3

(D) 2175 m^3

19 Chloe is an ecologist who is concerned about the cane toad population in the local community. She collects 280 cane toads and tags them. A couple of months later she collects 80 cane toads and found 32 of them were tagged. What is her estimate of the cane toad population using the capture-recapture method?

(A) 112

(B) 312

(C) 360

(D) 700

20 Daniel studies English, Mathematics, Visual Arts and Multimedia. A summary of his first assessment task results is shown below

Course	Mean	Standard deviation	Result
English	66%	5	76%
Mathematics	58%	15	88%
Visual Arts	49%	14	77%
Multimedia	42%	12	78%

Which course did Daniel achieve his best performance?

(A) English

(B) Mathematics

(C) Visual Arts

(D) Multimedia

21 The number of residents at Emma Park is expected to increase using the formula
$N = 4500t^3$, where N is the number of residents and t is the time in years.

What is the expected number of residents of Emma Park after three years?

(A)   13 500

(B)   40 500

(C)   121 500

(D)   148 500

22 The side view of a shed is shown below.

250 mm

250 mm

2800 mm   Not to scale

2000 mm

2400 mm
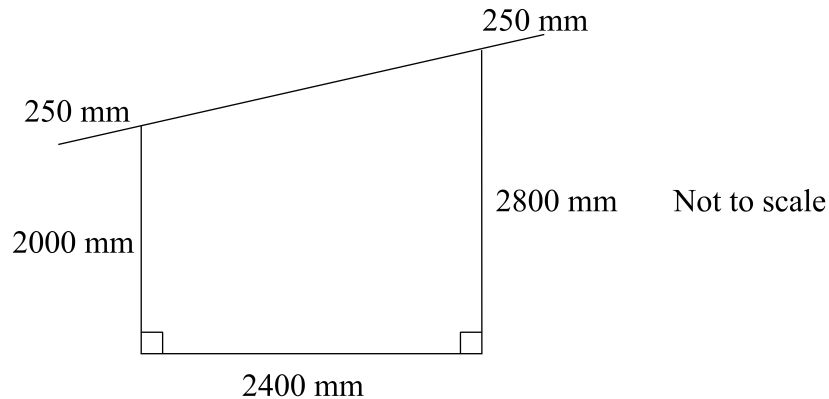
What is the length of the sloping roof, to the nearest mm?

(A)   2530 mm

(B)   3688 mm

(C)   3030 mm

(D)   41 mm

23 Isabella achieved a mean of 54 and a standard deviation of 10 in her first assessment task
in five subjects. In the second assessment she aims to improve by 5 marks in every
subject. What would be the effect of this improvement on the mean and standard
deviation?

(A)   Mean and standard deviation will remain the same.

(B)   Mean remains the same and the standard deviation will increase.

(C)   Mean will increase and the standard deviation will remain the same.

(D)   Mean and standard deviation will both increase.

24 A swimming event at Dover (51˚N, 1˚E) is being televised live in Sydney (34˚S, 151˚E).
The event starts at 1.30 pm Friday in Dover.

What is the time in Sydney at the start of the swimming event?

(A)   11.30 pm Friday

(B)   3.30 am Friday

(C)   11.30 pm Thursday

(D)   3.30 am Thursday

8

25 Louise is prescribed 900mg per day of a drug called Londane.
Londane is available in tablets which each contain 200 mg.
If she is to take the Londane twice a day, how many tablets should Louise take each time?

(A) $1\frac{3}{4}$ tablets

(B) $2\frac{1}{4}$ tablets

(C) $2\frac{1}{2}$ tablets

(D) $2\frac{3}{4}$ tablets

End of Section I

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)   A regular hexagonal spinner has four divisions as shown below.
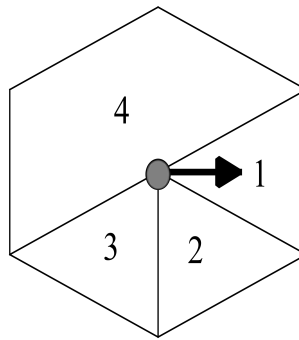
The spinner is spun twice to form a two-digit number such as '23'.

(i)   How many different two-digit numbers are possible?   **1**

(ii)   What is the probability that the arrow lands on the number '2' on the
           first spin?   **1**

(iii)   What is the probability that the number '14' is formed?   **1**

(iv)   What is the probability that an even two-digit number is formed?   **1**

(b) Two ships leave Sydney harbour (*A*). Ship *B* sails in a direction of 048˚ for 101 kilometres and ship *C* sails due south for 85 kilometres.

N

B

Not to scale

A

C
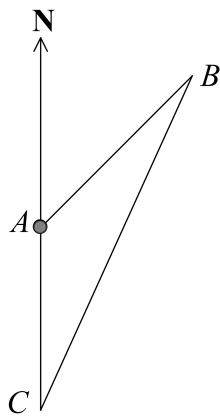
(i) Find the size of angle *BAC*.   **1**

(ii) Calculate the distance between the two ships to the nearest kilometre.   **2**

(iii) What is the bearing, to the nearest degree, of ship *B* from ship *C*?   **2**

(c) Jack scored 66% in the first assessment task for which the mean was 82% and the standard deviation was 8. In the second assessment task the mean was 71% and standard deviation was 10. Jack scored 61%.
Did Jack improve? Justify your answer.   **2**

11

(d) The table below shows the arm spam of five students.

Name	Ava	Ben	Chris	Dan	Eve
Arm span (cm)	176	162	161	190	170

   (i) Calculate the population mean. **1**

   (ii) A sample of two people is chosen at random.
How many samples are possible? **1**

(e) Mitch owns a credit card that has no annual fees and charges a flat rate of **2**
19.75% p.a. interest on all purchases. Find the interest charged on $1800 for
15 days. Answer correct to the nearest cent.

Question 27 (15 marks)   **Marks**

(a) A surveyor sketched this diagram of a garden bed in a rectangular field.
     All measurements are in metres.

(i)   Calculate the area of rectangle *ABCD*.   **1**

(ii) Use Simpson's rule twice to estimate the unshaded area *PQCD*.   **2**

(iii) The surveyor calculated the area of the shaded region *ABQP* to be
      156m². What is the area of the garden bed?   **1**

(b) The cost per passenger of hiring a bus is inversely proportional to the   **2**
     number of passengers on the bus. If there are twenty passengers, the cost per
     passenger is $14. What is the cost per passenger when there are fifteen
     passengers?

(c)   A machine creates metal disks with mean diameter of 4.50 cm and a standard deviation of 0.03 cm. The diameters of these metal disks are normally distributed.

   (i)   State the interval where 99.7% of the diameters of the metal disks will be?   **1**

   (ii)   A metal disk is produced at random with a diameter of 4.62 cm. Why is the manager concerned?   **1**

(d)   The two-way table presents the effectiveness of a drug to reduce blood pressure.

	Decrease in blood pressure	No change in blood pressure	Total
Reaction	7	**A**	12
No reaction	84	9	93
	91	14	**B**

   (i)   How many people had no change in blood pressure but had a reaction? **(A)**   **1**

   (ii)   How many people were tested with the drug? **(B)**   **1**

   (iii)   What percentage of people had a decrease in blood pressure with no reaction?   **2**

14

(e)   Jack is on the following mobile phone plan:

$60 Saver Plan	
Minimum monthly cost $ 60.00.	
$100 of voice calls included each month.	Voice calls: Connection fee : $0.20 Call cost : $1.10 per minute
1 GB of data included each month.	Data: $0.20 per MB.
$40 of SMS included each month.	SMS: $0.18 each.

1

In August Jack used an average of 40 MB of data per day. How many MB of data did he use *in excess* of his included data for the month?
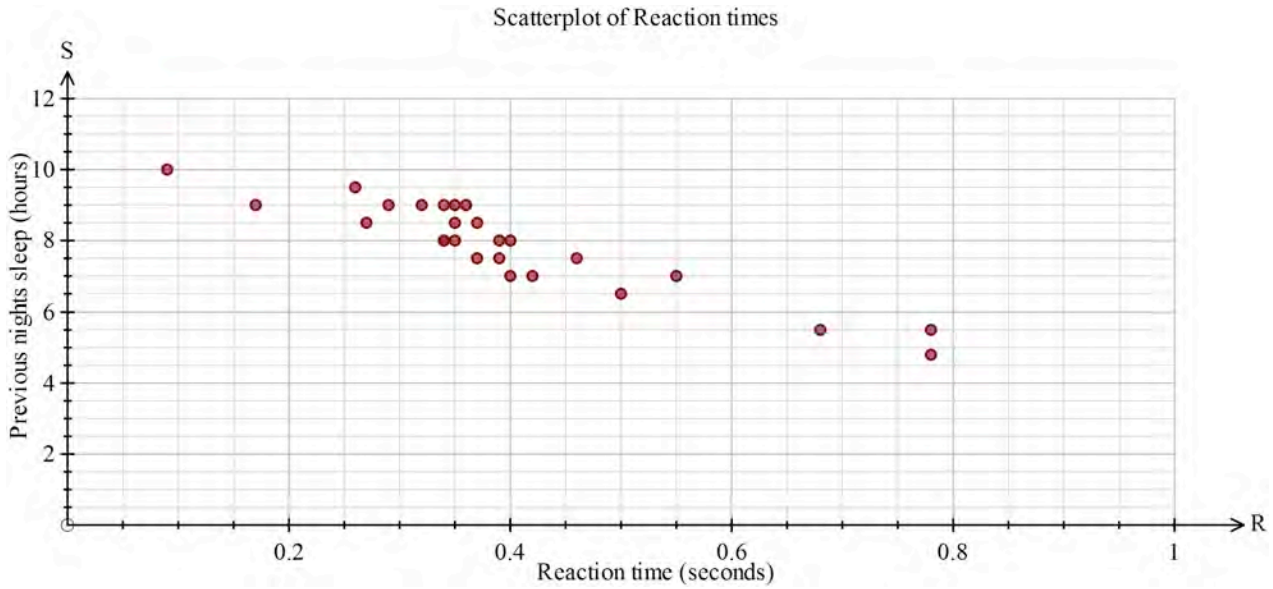

(f) Miriam was investigating the effect of lack of sleep on drivers.
She collected data on reaction times and compared these to the hours of
sleep of the participants.
The results are shown on the scatterplot below.

Scatterplot of Reaction times

(i) Miriam calculates the least squares line of best fit to have an
equation of : $S = -7.5R + 10.8$.

1

Draw the line on the graph above.

....

(ii) Estimate the reaction time of a person who had 6 hours sleep before
the test.

1

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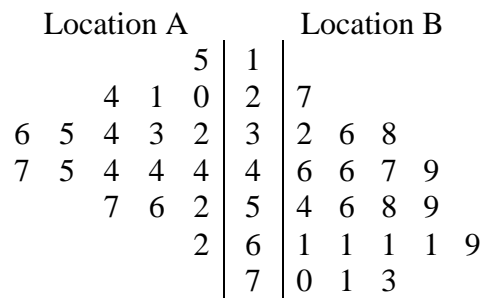
Question 28 (15 marks)   **Marks**

(a)   A geologist collected rock samples from two different locations. The weight
      of the rocks (in grams) is shown in the stem-and-leaf plot.

```
         Location A            Location B
                   5 │ 1 │
               4 1 0 │ 2 │ 7
           6 5 4 3 2 │ 3 │ 2 6 8
           7 5 4 4 4 │ 4 │ 6 6 7 9
               7 6 2 │ 5 │ 4 6 8 9
                   2 │ 6 │ 1 1 1 1 9
                     │ 7 │ 0 1 3
```

(i)   The five-number summary for the rocks collected at location A is   **2**
       shown in the table below.

Rock samples	Location A	Location B
Minimum weight	15	
Lower quartile	32	
Median	40	
Upper quartile	47	
Maximum weight	62	

Using the data in the stem-and-leaf plot, write down the five-number
summary for the weights of the rock samples from location B.

(ii)   Compare and contrast the rock samples from the two locations.   **2**

17

(b)   The table below shows the present value of a $1 annuity.

	Present value of $1				
Period	1%	2%	4%	6%	8%
1	0.9901	0.9804	0.9615	0.9434	0.9259
2	1.9704	1.9416	1.8861	1.8334	1.7833
3	2.9410	2.8839	2.7751	2.6730	2.5771
4	3.9020	3.8077	3.6299	3.4651	3.3121

(i)   What would be the present value of a $3 500 per year annuity at 2% per annum for 4 years, with interest compounding yearly?   **1**

(ii)   What is the value of an annuity that would provide a present value of $17 175 after 3 years at 6% per annum compound interest? Answer to the nearest dollar.   **1**

(iii)   An annuity of $2000 is invested each six months at 8% per annum, compounded biannually for 2 years.
What is the present value of the annuity?   **1**

(c)   Solve the following equations.
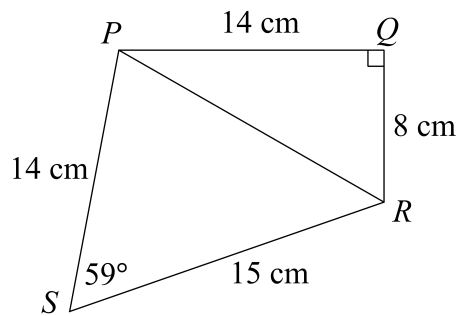
(i) $3(4c - 7) = 3c$ **1**

....

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....

(ii) $\dfrac{1}{6}x + \dfrac{1}{3}x = 12$ **2**

....

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(d)   Find the area of quadrilateral *PQRS*. Answer correct to two decimal places.   **2**

Not to scale

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19

(e) A plane trip from Beijing (GMT +8) to Madrid (GMT +1) takes 15 hours.   **1**
Dylan leaves Beijing at 7.15 am on the 1st April.
What is the date and time Dylan arrives in Madrid?

(f) What is the maximum value of the quadratic function $y = 6x - x^2$?   **2**
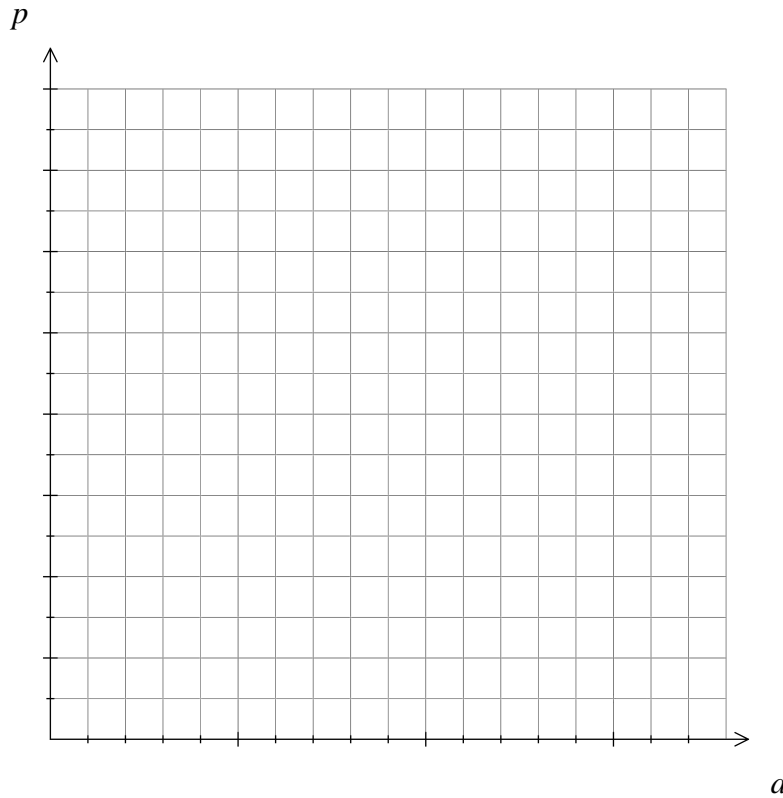
Question 29 (15 marks)   **Marks**

(a) The table below compares age (in years) and pulse rate (in beats per minute).

a	5	10	15	20	25	30
p	62.6	64.1	65.9	67.6	69.0	70.4

    (i)   Draw a scatterplot using this data.   **1**

p

a

    (ii)   Calculate the value of the correlation coefficient. Answer correct to three decimal places.   **1**

    (iii)   Find the equation of the least-squares line of best fit.   **2**

    (iv)   Estimate the pulse rate when the age is 35 years.   **1**

(b)   Rossel Island is located at (11˚S, 153˚E) and Brisbane at (27˚S, 153˚E).

   (i)   What is the angular distance between Rossel Island and Brisbane?   **1**

....

....

....

   (ii)   Find the distance between Rossel Island and Brisbane? Answer to the   **1**
         nearest kilometre.

....

....

....

....

....

(c)   The life expectancy in a low socio-economic country is show below.

Current age	Female	Male
20	63.88	58.99
25	59.33	55.03
30	54.48	50.83
35	49.71	45.67
40	45.97	42.75

   (i)   What is life expectancy of a 25-year-old female?   **1**

....

....

....

   (ii)   What is the difference between the life expectancies of a 35-year-old   **1**
         male and female?

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(d) Jayden is a travelling salesperson and drives 800 km per week on average. His car is serviced every 10 000 km, costing approximately $550 each time. Jayden's car uses 10 L of petrol per 100 km and the cost of petrol is $1.50 per litre. He is also required to pay registration for $360, third party insurance for $540 and comprehensive car insurance for $680.

    (i)   What is annual cost to service the car? **2**

    (ii)   How much does Jayden pay for petrol in one year? **1**

    (iii)   Calculate the total running costs for one year. **1**

(e) Joshua is going on a 6-week holiday. He estimates taking 300 photos per day with each photo 1.5 MB. Joshua has a camera with a 16 GB memory card.

    (i)   How many photos can be stored on the memory card? **1**

    (ii)   How many memory cards will Joshua need on his holiday? **1**

Question 30 (15 marks)   **Marks**

(a) Items with a different mass (*m* in kg) are attached to a spring. The length of
     the spring (*L* in cm) is measured for each item. The results are shown below.

m	2	5	8	11	14	17
L	41.2	55.0	68.8	82.6	96.4	110.2

    (i)   A linear model in the form $L = km + 32$ describes this situation.   **1**
            What is the value of *k*?

    (ii)   What is the length of the spring when no item is attached?   **1**

    (iii)   Calculate the mass of an item that will make the spring 78 cm long?   **1**

(b) Emma has 8 different paintings, but has space to hang only 3 of them.

    (i)   Emma selects 3 of these paintings.   **1**
            How many ways can she arrange them in a row?

    (ii)   How many different groups of 3 paintings can Emma select?   **1**

24

(c)   After the recent drought the rain gauge on a farm registered 65 mm of rain during a storm. A barn on the farm has a rectangular roof measuring 24 metres by 12 metres.

(i)   How many kilolitres of water fell on barn roof during the storm?   **1**

(ii)   The rain falling on the barn roof is collected in a cylindrical tank with a diameter of 5 metres. The tank was empty before the storm.
What depth of water was in the tank after the storm? Answer correct to two decimal places.   **2**

(iii)   The height of the tank is 2 metres. How many more litres can fall before the tank begins to overflow? Answer to the nearest litre.   **2**

(d) Given the formula $\dfrac{b}{a} = \dfrac{a}{c+8}$

    (i)   Make a the subject of the formula.   **1**

    (ii)   If $b = 4$ and $c = 1$, what is the value of a?   **1**

(e) A bank has offered Charlotte a home loan of \$368 000 with monthly repayments of \$2592 for 30 years.

    (i)   How much interest will she pay?   **1**

    (ii)   Charlotte has the option of paying an extra \$240 per month. This results in the loan being repaid in 23 years and 1 month.   **2**
How much interest will Charlotte save by paying the extra amount?

End of paper

Section II   Extra writing space

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

Section II   Extra writing space

Student Name: *Worked Solutions*

2015
YEAR 12
TRIAL 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
- In Questions 26-30, show relevant mathematical reasoning and/or calculations

Total marks - 100

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25 marks

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- Use Multiple Choice answer sheet provided
- Allow about 35 minutes for this section

Section II

75 marks

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- Answer the questions in the spaces provided
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Year 12 Mathematics General 2 Section I - Answer Sheet

Student Name/Number _____ ANSWERS _____

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.

correct

A ●   B ⊗   C ○   D ○

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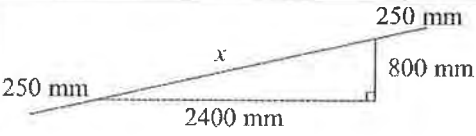
1. A ○   B ○   C ●   D ○

2. A ●   B ○   C ○   D ○

3. A ○   B ●   C ○   D ○

4. A ●   B ○   C ○   D ○

5. A ●   B ○   C ○   D ○

6. A ○   B ●   C ○   D ○

7. A ●   B ○   C ○   D ○

8. A ○   B ○   C ●   D ○

9. A ○   B ●   C ○   D ○

10. A ○   B ●   C ○   D ○

11. A ○   B ●   C ○   D ○

12. A ○   B ○   C ○   D ●

13. A ●   B ○   C ○   D ○

14. A ●   B ○   C ○   D ○

15. A ○   B ○   C ●   D ○

16. A ○   B ●   C ○   D ○

17. A ○   B ●   C ○   D ○

18. A ○   B ○   C ●   D ○

19. A ○   B ○   C ○   D ●

20. A ○   B ○   C ○   D ●

21. A ○   B ○   C ●   D ○

22. A ○   B ○   C ●   D ○

23. A ○   B ○   C ●   D ○

24. A ●   B ○   C ○   D ○

25. A ○   B ●   C ○   D ○

FRENSHAM Examination 2015

HSC Mathematics General 2 Yearly Examination

Worked solutions and marking guidelines

Section 1			
		Solution	**Criteria**
1		$\dfrac{24a^5b^2}{2a^2b} = 12a^3b \neq 12a^3b^2$	1 Mark: C
2		Age increases and foot length increases. Positive correlation.	1 Mark: A
3		$\sin 41° = \dfrac{AD}{12}$ $\quad AD = 12 \times \sin 41°$	1 Mark: B
4		Hours worked $= 29 + 8 \times 1.5 = 41$ Hourly rate $= \$697 \div 41$ $\quad\quad = \$17.00$	1 Mark: A
5		$P(BB) = \dfrac{2}{20} \times \dfrac{1}{19} = \dfrac{1}{190}$	1 Mark: A
6		Cost $= (\$1.80 \times 250) + [\$2.20 \times (480 - 250)]$ $\quad\quad = \$956$	1 Mark: B
7		$y = \dfrac{2}{x}$ is a hyperbolic function.	1 Mark: A
8		$r = 6.75\%$, $n = 10$ years Intersection value is $\$11.48$ Monthly repayment $= \$11.48 \times 84$ $\quad\quad\quad\quad = \$964.32$	1 Mark: C
9		Largest angle is opposite the largest side. $\cos C = \dfrac{65^2 + 44^2 - 72^2}{2 \times 65 \times 44}$	1 Mark: B
10		$3y + 5 = 5(y-1) \quad\quad\quad -2y + 5 = -1 ..... \text{Line2}$ $3y + 5 = 5y - 5 ..... \text{Line1} \quad -2y = -6 ..... \text{Line3}$ Line 1 and line 3 have errors in their working.	1 Mark: B

11	$I = Prn$ $= \$60\,000 \times \dfrac{0.0975}{12} \times 1$ $= \$487.50$ Amount owed $= \$60\,000 + \$487.50 - \$1312.50$ $\qquad\qquad\quad = \$59175$	1 Mark: B
12	Flow rate $= \dfrac{1.8 \times 1000 \text{ mL}}{12}$ $\qquad\qquad = 150 \text{ mL/h}$	1 Mark: D
13	1 truck there are 5 cars 2 trucks there are 10 cars $C = 5T$	1 Mark: A
14	Tax payable = \$39\,640 − \$3\,240 = \$36\,400 Taxable income between \$18\,201 and \$37\,000 (2nd line) Tax payable = Nil + (\$36\,400 − \$18\,200) × 0.19 $\qquad\qquad\quad$ = Nil + \$18\,200 × 0.19	1 Mark: A
15	$3 = \sqrt{\dfrac{L}{9.8}}$ $9 = \dfrac{L}{9.8}$ $L = 9 \times 9.8$	1 Mark: C
16	$A = \dfrac{1}{2}bh = \dfrac{1}{2} \times 12 \times 5 = 30 \text{ cm}^2$ Use Pythagoras theorem to find the length of the top face. $x^2 = 12^2 + 5^2$ $x = \sqrt{169} = 13 \text{ cm}$ $SA = (2 \times 30) + (13 \times 15) + (12 \times 15) + (5 \times 15)$ $\qquad = 510 \text{ cm}^2$	1 Mark: B
17	$A = P(1+r)^n$ $= \$35\,000\left(1 + \dfrac{0.048}{2}\right)^{5 \times 2}$ $= \$35\,000(1.024)^{10}$ $I = A - P$ $= \$35\,000(1.024)^{10} - \$35\,000$	1 Mark: B
18	$V = \dfrac{h}{3}(A_f + 4A_m + A_l)$ $= \dfrac{15}{3} \times (22 + 4 \times 25 + 23) = 725 \text{ m}^3$	1 Mark: C

19	$$\frac{280}{p} = \frac{32}{80}$$ $$32p = 22,400$$ $$p = 700$$ Cane toad population is approximately 700.	1 Mark: D
20	English $z = \dfrac{x - \bar{x}}{s} = \dfrac{76 - 66}{5} = 2$ Mathematics $z = \dfrac{x - \bar{x}}{s} = \dfrac{88 - 58}{15} = 2$ Visual Arts $z = \dfrac{x - \bar{x}}{s} = \dfrac{77 - 49}{14} = 2$ Multimedia $z = \dfrac{x - \bar{x}}{s} = \dfrac{78 - 42}{12} = 3$ (Highest z-score)	1 Mark: D
21	$$N = 4,500t^3$$ $$= 4,500 \times 3^3$$ $$= 121,500$$	1 Mark: C
22	Using Pythagoras theorem $$x^2 = 2400^2 + 800^2$$ $$x = 2529.822128... \approx 2530 \text{ mm}$$ Roof length $\approx 250 + 250 + 2530$ $$\approx 3030 \text{ mm}$$	1 Mark: C
23	Mean will increase and the standard deviation will remain the same. (Mark will increase from 54 to 59 and the spread is unaffected)	1 Mark: C
24	Longitude difference $= 151^\circ - 1^\circ = 150^\circ$ Time difference $= 150 \times 4 = 600$ min or 10h Dover $\quad$ Sydney 1° E $\qquad$ 151° E $\longleftarrow$ $\qquad$ $\longrightarrow$ $-$ West $\qquad$ East $+$ Time in Sydney $= 1.30$ pm $+ 10$ h $$= 11.30 \text{ pm Friday}$$	1 Mark: A

3

25	900mg/day prescribed each day, therefore, number of tablets per day $$= \frac{900mg}{200mg}$$ $$= 4.5$$ which means 2.25 tablets each time (twice each day) or	1 mark: B
	each dose $= \dfrac{900}{2} = 450mg$ therefore , number of tablets each time $= \dfrac{450mg}{200mg} = 2.25$	

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)   A regular hexagonal spinner has four divisions as shown below.

← Draw in the triangles

Outcomes
11, 21, 31, 41
12, 22, 32, 42
13, 23, 33, 43.
14, 24, 34, 44
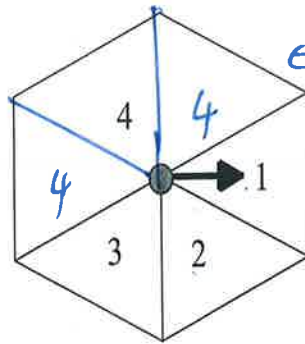
The spinner is spun twice to form a two-digit number such as '23'.

(i)   How many different two-digit numbers are possible?   **1**

$$4 \times 4 = \underline{16}$$

(ii)   What is the probability that the arrow lands on the number '2' on the first spin?   **1**

$$P(2) = \underline{\frac{1}{6}}$$

(iii)   What is the probability that the number '14' is formed?   **1**

$$P(14) = \frac{1}{6} \times \frac{1}{2} = \underline{\frac{1}{12}}$$

Draw a
probability tree

ends in 2 or 4

(iv)   What is the probability that an even two-digit number is formed?   **1**

$$P(even) = 3\left(\frac{1}{6} \times \frac{1}{6}\right) + 4\left(\frac{1}{6} \times \frac{1}{2}\right) + \left(\frac{1}{2} \times \frac{1}{2}\right)$$
$$= \underline{\frac{2}{3}}$$
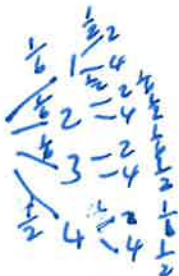
(b)   Two ships leave Sydney harbour (A). Ship B sails in a direction of 048° for 101 kilometres and ship C sails due south for 85 kilometres.

N

B

101 km

48°

A 132°

85km

Not to scale

C
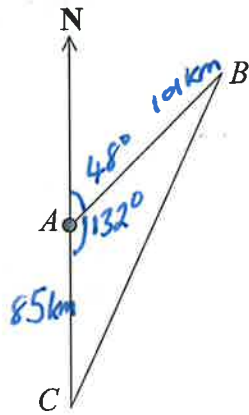
(i)   Find the size of angle BAC.   **1**

$$180 - 48 = \underline{132°}$$

(ii)   Calculate the distance between the two ships to the nearest kilometre.   **2**

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$BC^2 = 85^2 + 101^2 - 2 \times 85 \times 101 \times \cos 132$$
$$BC = 170.04403..$$
$$BC = \underline{170 \, km}$$

(1) substitutes correctly

(1) correct answer.

(iii)   What is the bearing, to the nearest degree, of ship B from ship C?   **2**

$$\frac{\sin C}{101} = \frac{\sin 132}{170.04403}$$

$$\sin c = \frac{101 \times \sin 32}{170.04403}$$

$$\therefore c = 26°$$ $$\therefore Bearing = \underline{026°}$$
$$or \; N26°E$$

(1) Correct substitution

(1) answer given as a bearing.

(c)   Jack scored 66% in the first assessment task for which the mean was 82%   **2**
and the standard deviation was 8. In the second assessment task the mean
was 71% and standard deviation was 10. Jack scored 61%.

Did Jack improve? Justify your answer.

$$Z_{first} = \frac{66-82}{8} = -2$$

$$Z_{second} = \frac{61-71}{10} = -1$$

(1) mark for working

∴ Jack has improved as z-score has increased
or standard deviation is closer to the mean
(1) for justification.

11

(d) The table below shows the arm spam of five students.

Name	Ava	Ben	Chris	Dan	Eve
Arm span (cm)	176	162	161	190	170

(i) Calculate the population mean. **1**

$$\mu = \frac{176 + 162 + 161 + 190 + 170}{5}$$

$$\mu = 171.8 -$$

(ii) A sample of two people is chosen at random. **1**
How many samples are possible?

$$5C_2 = 10$$

$$\therefore \underline{10} \text{ possible samples}$$

(e) Mitch owns a credit card that has no annual fees and charges a flat rate of **2**
19.75% p.a. interest on all purchases. Find the interest charged on $1800 for
15 days. Answer correct to the nearest cent.

$I = 1800$

$r = 0.1975/365$

$n = 15 \text{ days}$

$I = P \times r \times n$

$= \frac{1800 \times 0.1975 \times 15}{365}$ (1) converts to a daily rate

$= 14.60958$

$= \$14.61$ (1) correct answer.

Question 27 (15 marks)   **Marks**

(a) A surveyor sketched this diagram of a garden bed in a rectangular field.
     All measurements are in metres.
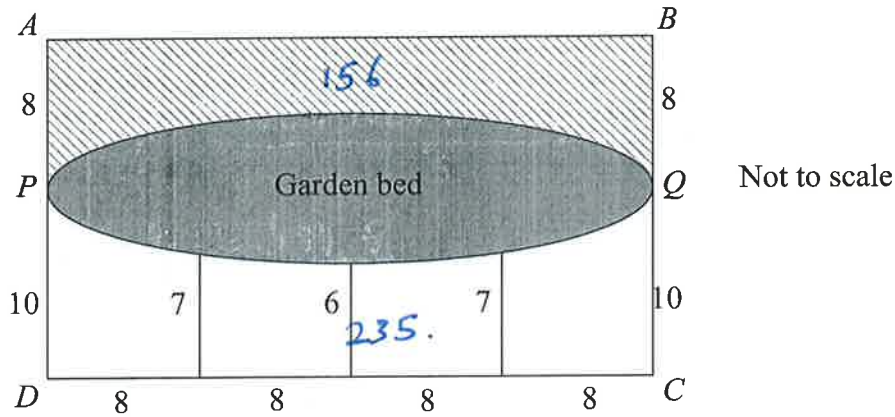
(i)   Calculate the area of rectangle *ABCD*.   1

$$A = l \times b = 18 \times 32 = 576 m^2$$

(ii) Use Simpson's rule twice to estimate the unshaded area *PQCD*.   2

$$A = \frac{h}{3}(d_f + 4d_m + d_e) + \frac{h}{3}(d_f + 4d_m + d_e)$$
$$= \frac{8}{3}(10 + (4\times7) + 6) + \frac{8}{3}(6 + 4\times7 + 10)$$ (1) progress made
$$= 234.666$$
$$\simeq 235 m^2$$ (1) correct answer

(iii) The surveyor calculated the area of the shaded region *ABQP* to be   1
      156m². What is the area of the garden bed?

$$A = 576 - 235 - 156$$
$$= 185 m^2$$

(b) The cost per passenger of hiring a bus is <u>inversely</u> proportional to the   2
     number of passengers on the bus. If there are twenty passengers, the cost per
     passenger is $14. What is the cost per passenger when there are <u>fifteen</u>
     passengers?

$$C = \frac{k}{n} \qquad \therefore C = \frac{280}{n}$$
$$14 = \frac{k}{20} \qquad = \frac{280}{15}$$
$$280 = k \qquad = 18.666$$
$$= \$18.67 \quad (1) \text{ correct answer}$$

(1) Finds the value of k

13

(c) A machine creates metal disks with mean diameter of 4.50 cm and a standard deviation of 0.03 cm. The diameters of these metal disks are normally distributed.

(i) State the interval where 99.7% of the diameters of the metal disks will be? **1**

3 standard deviations

$$4.5 + (3 \times 0.03) = 4.59$$
$$4.5 - (3 \times 0.03) = 4.41$$

∴ Interval is 4.41 to 4.59 cm

(ii) A metal disk is produced at random with a diameter of 4.62 cm. Why is the manager concerned? **1**

The manager is concerned because 4.62 is 4 standard deviations above the mean. ∴ Extremely unlikely and indicates the machine is not functioning correctly.

(d) The two-way table presents the effectiveness of a drug to reduce blood pressure.

	Decrease in blood pressure	No change in blood pressure	Total
Reaction	7	A ⑤	12
No reaction	84	9	93
	91	14	B ⑩⑤

(i) How many people had no change in blood pressure but had a reaction? **(A)** **1**

$$12 - 7 = 5$$

(ii) How many people were tested with the drug? **(B)** **1**

$$91 + 14 = 105$$

(iii) What percentage of people had a decrease in blood pressure with no reaction? **2**

$$\frac{84}{105} \times 100 = 80\% \quad (1) \text{ correct answer.}$$

(1) used either 84 or 105

14

(e) Jack is on the following mobile phone plan:

$60 Saver Plan

Minimum monthly cost $ 60.00.

$100 of voice calls included each month. | Voice calls:
Connection fee : $0.20
Call cost : $1.10 per minute

×2 ⟍ ↗1024 mB

1 GB of data included each month. | Data: $0.20 per MB.

$40 of SMS included each month. | SMS: $0.18 each.

1

In August Jack used an average of 40 MB of data per day. How many MB of data did he use *in excess* of his included data for the month?

Total data = 40 × 31 days = 1240 mB .

1240 − 1024 = 216 mB excess.

Question 27 continues on next page

15

(f) Miriam was investigating the effect of lack of sleep on drivers.
She collected data on reaction times and compared these to the hours of
sleep of the participants.
The results are shown on the scatterplot below.

Scatterplot of Reaction times
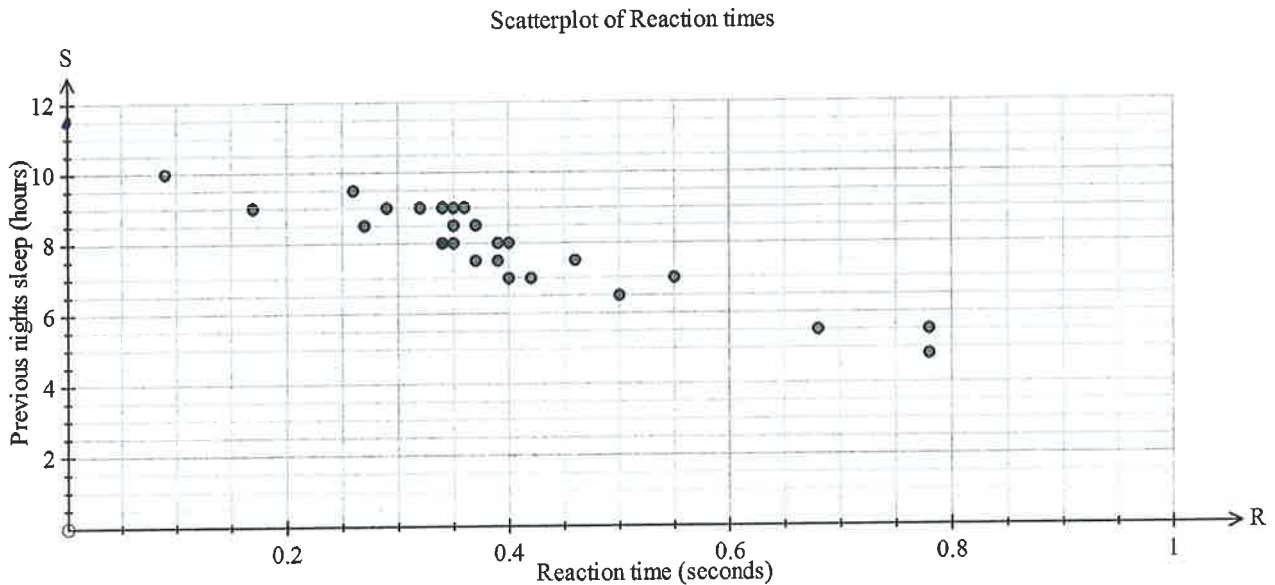
To draw the graph use the equation for any 2 points.

(i) Miriam calculates the least squares line of best fit to have an   1
equation of : $S = -7.5R + 10.8$.

Draw the line on the graph above.

See above .

(ii) Estimate the reaction time of a person who had 6 hours sleep before
the test.   1

$\therefore (S = 6)$

$$S = -7.5R + 10.8$$
$$6 = -7.5R + 10.8$$
$$-4.8 = -7.5R$$
$$\frac{-4.8}{-7.5} = R$$
$$0.64 = R$$

If reading off graph 0.6 (to the nearest 10TH sec)

16

Question 28 (15 marks)   **Marks**

(a)   A geologist collected rock samples from two different locations. The weight
      of the rocks (in grams) is shown in the stem-and-leaf plot.

```
        Location A            Location B
                  5 | 1 |
              4 1 0 | 2 | 7
          6 5 4 3 2 | 3 | 2 6 8
          7 5 4 4 4 | 4 | 6 6 7 9
              7 6 2 | 5 | 4 6 8 9
                  2 | 6 | 1 1 1 1 9
                      | 7 | 0 1 3
```
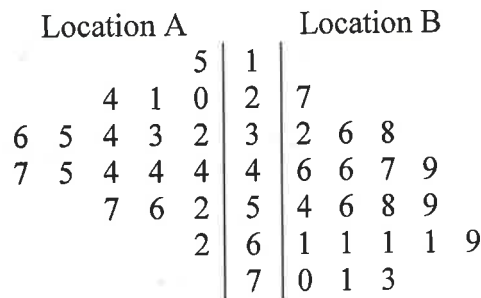
(i)   The five-number summary for the rocks collected at location A is   **2**
      shown in the table below.

Rock samples	Location A	Location B
Minimum weight	15	27
Lower quartile	32	46
Median	40	57
Upper quartile	47	61
Maximum weight	62	73

Using the data in the stem-and-leaf plot, write down the five-number
summary for the weights of the rock samples from location B.

(1) any 2 correct answers
(2) all correct.

(ii) Compare and contrast the rock samples from the two locations.   **2**

Range A = 47   Range B = 46   A larger range.
IQR A = 15   IQR B = 15   the same.
median A = 40   median B = 57 median A smaller.
∴ Lower weights in A.
∴ A = normal distribution / B = negatively skewed.

(1) shows some understanding
(2) correct answer

17

(b) The table below shows the present value of a $1 annuity.

Present value of $1					
Period	1%	2%	4%	6%	8%
1	0.9901	0.9804	0.9615	0.9434	0.9259
2	1.9704	1.9416	1.8861	1.8334	1.7833
3	2.9410	2.8839	2.7751	2.6730	2.5771
4	3.9020	3.8077	3.6299	3.4651	3.3121

(i) What would be the present value of a $3 500 per year annuity at 2% per annum for 4 years, with interest compounding yearly?   **1**

Intersection value = 3.8077

$$\therefore PV = 3.8077 \times 3500$$
$$= \$13,326.95$$

(ii) What is the value of an annuity that would provide a present value of $17 175 after 3 years at 6% per annum compound interest? Answer to the nearest dollar.   **1**

Intersection value = 2.6730

$$\therefore \$17175 = x \times 2.6730$$
$$\frac{17175}{2.6730} = x$$
$$\$6425/yr. = x$$

(iii) An annuity of $2000 is invested each six months at 8% per annum, compounded biannually for 2 years. ×2   /2   **1**
What is the present value of the annuity?

Intersection is 3.6299. (4% and 4yrs)

$$PV = 3.6299 \times 2000$$
$$= \$7259.80$$

(c) Solve the following equations.

(i) $3(4c - 7) = 3c$ **1**

$$12c - 21 = 3c$$
$$9c = 21$$
$$c = \frac{21}{9} = 2\frac{1}{3}$$

(ii) $\frac{1}{6}x + \frac{1}{3}x = 12$ **2**

$$\frac{1}{6}x + \frac{2}{6}x = 12$$
$$\frac{3}{6}x = 12$$
$$3x = 72$$
$$x = 24$$

(d) Find the area of quadrilateral *PQRS*. Answer correct to two decimal places.   **2**

P   14 cm   Q
14 cm
8 cm
Not to scale
R
59°   15 cm
S
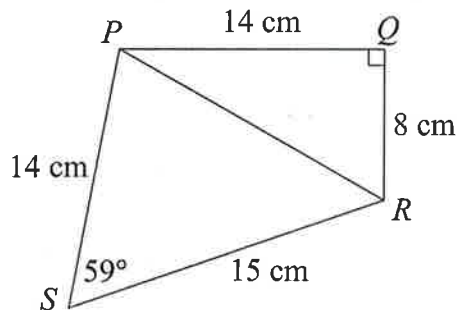
$$\text{Area } \Delta PQR = \frac{1}{2} 14 \times 8 = 56$$
$$\text{Area } \Delta PRS = \frac{1}{2} 14 \times 15 \times \sin 59 \quad \} \; (1) \text{ finds area of 1 triangle.}$$
$$\doteqdot 90.002566.$$
$$\text{Area } PQRS = 56 + 90 = 146.00 \quad (1)$$
to 2 decimal places.

(e)   A plane trip from Beijing (GMT +8) to Madrid (GMT +1) takes 15 hours.   **1**
Dylan leaves Beijing at 7.15 am on the 1st April.
What is the date and time Dylan arrives in Madrid?

Time difference = 8 − 1 = 7 hours.

1st April Madrid   − timediff + journeytime
7.15am   −   7h   +   15hr   =   3.15pm 1st April.

(f)   What is the maximum value of the quadratic function $y = 6x - x^2$?   **2**

x	0	1	2	3	4	5	6
y	0	5	8	9	8	5	0

(1) Draws a table of values or a graph

The maximum value is
9.
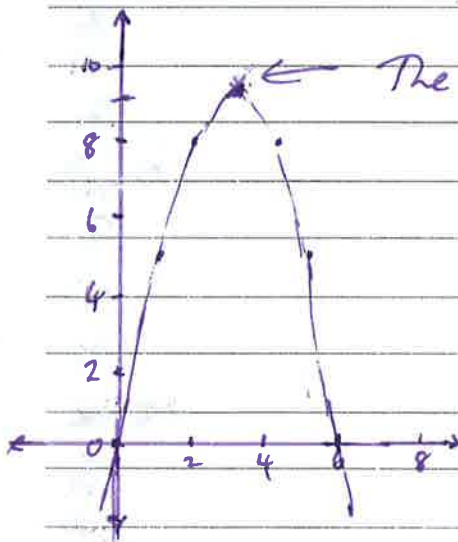
(2) Correct answer.

Question 29 (15 marks)   **Marks**

(a)   The table below compares age (in years) and pulse rate (in beats per minute).

a	5	10	15	20	25	30
p	62.6	64.1	65.9	67.6	69.0	70.4

(i)   Draw a scatterplot using this data.   1

(no line of fit should be drawn)

(STATS)
REG
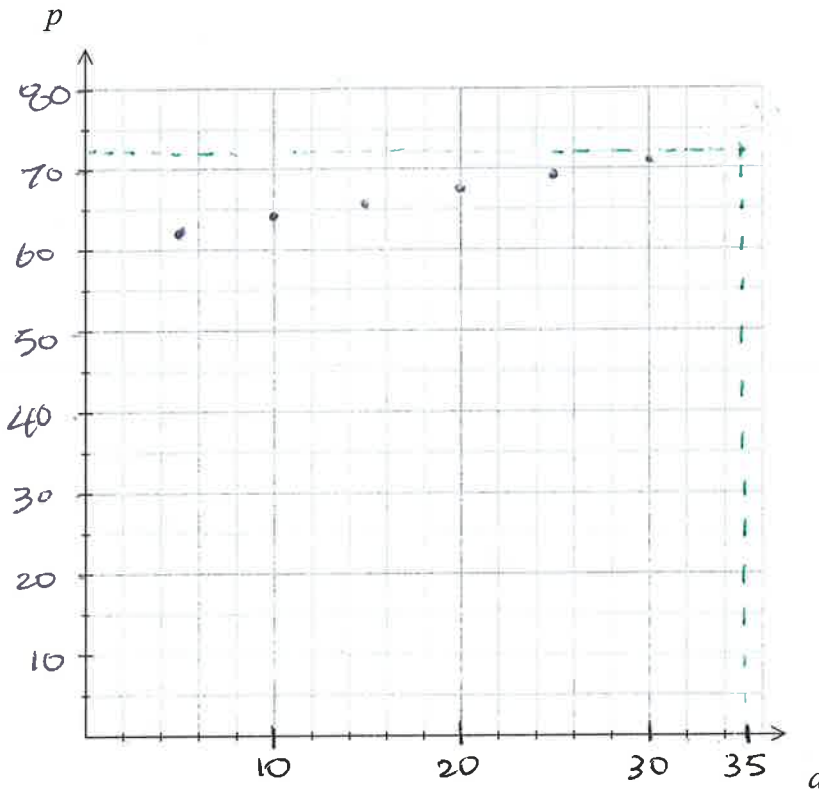
(ii)   Calculate the value of the correlation coefficient. Answer correct to
three decimal places.   1

(r) $0.9989... = 0.999$ $(3\ d.p)$.

(iii) Find the equation of the least-squares line of best fit.   2

A: (y-intercept) $A = 61.06$ B: (gradient) $B = 0.316...$

$y = 0.316x + 61.06$.

$\therefore p = 0.32a + 61.06$

(iv)   Estimate the pulse rate when the age is 35 years.   1

(equation) $p = 0.32(35) + 61.06$

$= 72.26$.

(extrapolate
on own
graph)

(i.e.
(dotted lines).

(b)   Rossel Island is located at (11°S, 153°E) and Brisbane at (27°S) 153°E).

   (i)   What is the angular distance between Rossel Island and Brisbane?   1

$$= 27 - 11$$
$$= 16°$$

   (ii)   Find the distance between Rossel Island and Brisbane? Answer to the   1
   nearest kilometre.

$$l = \frac{16}{360} \times 2 \times \pi \times 6400$$
$$= 1787.2171\ldots$$
$$= 1787 \text{ km} \quad (\text{nearest km})$$

(c)   The life expectancy in a low socio-economic country is show below.

Current age	Female	Male
20	63.88	58.99
25	59.33	55.03
30	54.48	50.83
35	49.71	45.67
40	45.97	42.75

   (i)   What is life expectancy of a 25-year-old female?   1

$$59.33 \text{ years.}$$

ignored error { some answers that added 25 + 59.33

   (ii)   What is the difference between the life expectancies of a 35-year-old   1
   male and female?

$$= 49.71 - 45.67$$
$$= 4.04 \text{ years.}$$

(d) Jayden is a travelling salesperson and drives 800 km per week on average. His car is serviced every 10 000 km, costing approximately $550 each time. Jayden's car uses 10 L of petrol per 100 km and the cost of petrol is $1.50 per litre. He is also required to pay registration for $360, third party insurance for $540 and comprehensive car insurance for $680.

(i) What is annual cost to service the car? **2**

$$\text{total annual } km = 800 \times 52$$
$$= 41600 km$$

$$\text{services} = \frac{41600 km}{10000 km} = 4.16 \therefore 4$$
$$\text{Cost} = 4 \times 550 = \$2200$$

(ii) How much does Jayden pay for petrol in one year? **1**

$$\text{Cost} = \frac{41600}{100} = 416$$
$$\text{total } L = 416 \times 10 L$$
$$= 4160$$
$$\text{total cost} = 4160 \times 1.50 = \$6240$$

(iii) Calculate the total running costs for one year. **1**

$$\text{Total cost} = 2200 + 6240 + 360 + 540 + 680$$
$$= \$10020$$

(e) Joshua is going on a 6-week holiday. He estimates taking 300 photos per day with each photo 1.5 MB. Joshua has a camera with a 16 GB memory card.

(i) How many photos can be stored on the memory card? **1**

$$16 \times 1GB$$
$$= 16 \times 1024 MB$$
$$= 16384$$

$$\frac{16384 MB}{1.5 MB}$$
$$= 10922.66\ldots$$
$$\therefore 10922 \text{ whole photos}$$
$$(\text{no more lost})$$

(ii) How many memory cards will Joshua need on his holiday? **1**

$$\text{total photos} = 300 \times 7 \times 6$$
$$= 12600 \text{ photos}$$

$$\text{Cards needed} = \frac{12600}{10922.6}$$
$$= 1.153\ldots$$

$$\therefore \quad 2 \text{ cards needed}$$

23

Question 30 (15 marks)   **Marks**

(a)   Items with a different mass (*m* in kg) are attached to a spring. The length of
      the spring (*L* in cm) is measured for each item. The results are shown below.

m	2	5	8	11	14	17
L	41.2	55.0	68.8	82.6	96.4	110.2

(i)   A linear model in the form $L = km + 32$ describes this situation.   1
      What is the value of *k*?

$$41.2 = 2k + 32$$
$$2k = 9.2$$
$$k = 4.6$$

(ii) What is the length of the spring when no item is attached?   1

find L when $m = 0$
$$L = 4.6m + 32$$
$$L = 32 \qquad \therefore \qquad 32cm .$$

(iii) Calculate the mass of an item that will make the spring 78 cm long?   1

$$L = 4.6m + 32$$
$$78 = 4.6m + 32$$
$$-32 \qquad\qquad -32$$
$$46 = 4.6m \qquad\qquad m = 10 kg .$$
$$\overline{46} \qquad \overline{4.6}$$

(b)   Emma has 8 different paintings, but has space to hang only 3 of them.

(i)   Emma selects 3 of these paintings.   1
      How many ways can she arrange them in a row? (only used 3)

$$\underline{3 \times 2 \times 1} \qquad = \quad 6 \text{ arrangements .}$$

(ii) How many different groups of 3 paintings can Emma select? (from the $^8_1$)   1

$$^8C_3 = 56 \qquad \Big| \qquad \frac{8 \times 7 \times 6}{3 \times 2 \times 1} = 56$$

24

24

12 / 24

(c) After the recent drought the rain gauge on a farm registered 65 mm of rain during a storm. A barn on the farm has a rectangular roof measuring 24 metres by 12 metres.
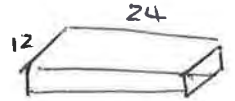
(i) How many kilolitres of water fell on barn roof during the storm?   1

$$V = Ah$$
$$= (24 \times 12) \times 0.065$$
$$= 18.72 \, m^3$$
$$= 18.72 \, KL$$

65mm = 0.065m

$1m^3 = 1000L = 1KL$

Issue!

∴ 18.72 KL fell on the roof

(ii) The rain falling on the barn roof is collected in a cylindrical tank with a diameter of 5 metres. The tank was empty before the storm. What depth of water was in the tank after the storm? Answer correct to two decimal places.   2

$d = 5$
$∴ r = 2.5$

$$V = \pi r^2 h$$
$$18.72 = \pi \times 2.5^2 \times h$$
$$h = \frac{18.72}{\pi \times 2.5^2}$$
$$= 0.95340\ldots$$
$$h = 0.95 \, m \quad (95 \, cm)$$
$$(2 \, d.p.)$$

(iii) The height of the tank is 2 metres. How many more litres can fall before the tank begins to overflow? Answer to the nearest litre.   2

$$\text{height left} = 2 - 0.95340\ldots$$
$$= 1.046598\ldots$$

$$V = \pi r^2 h$$
$$= \pi \times 2.5^2 \times 1.0465\ldots$$
$$= 20.549\ldots \, m^3$$
$$= 20.549\ldots \times 1000$$
$$= 20550 \, litres \quad (\text{nearest litre})$$

$V = \pi \times 2.5^2 \times 2$
$= 39.269 \, m^3$ ½

(∴ truncated answers will give inaccurate final result).

-1

25

(d) Given the formula $\dfrac{b}{a} = \dfrac{a}{c+8}$

   (i) Make a the subject of the formula. **1**

$$a^2 = b(c+8)$$
$$a = \pm\sqrt{b(c+8)}$$

$c+8 \quad \dfrac{b}{a} = \dfrac{a}{c+8} \quad (c+8)$

$a \times \dfrac{b(c+8)}{a} = a \times a$

$b(c+8) = a^2$

$a = \pm\sqrt{bc + b8}$

✗ ignored $\pm$

( ) not done well.

   (ii) If $b = 4$ and $c = 1$, what is the value of a? **1**

$$a = \pm\sqrt{b(c+8)}$$
$$= \pm\sqrt{4(1+8)}$$
$$= \pm\sqrt{36} \qquad = \pm 6$$

(wrong bald answer) no mark

(e) A bank has offered Charlotte a home loan of $368 000 with monthly repayments of $2592 for 30 years.

   (i) How much interest will she pay? **1**

$$\text{total paid} = 30 \times 12 \times 2592$$
$$= \$933\,120$$
$$\text{interest} = 933\,120 - 368\,000$$
$$= \$565\,120 \ (\text{paid in interest})$$

   (ii) Charlotte has the option of paying an extra $240 per month. This results in the loan being repaid in 23 years and 1 month. **2**
   How much interest will Charlotte save by paying the extra amount?

$$\text{total paid} = ((23 \times 12) + 1) \times (240 + 2592)$$
$$= 277 \times (2832)$$
$$= \$784\,464$$
$$\text{difference repaid interest saved} = 933\,120 - 784\,464$$
$$= \$148\,656$$

Saving $148 656 in interest

$$\begin{array}{r} 2592 \\ 240 \\ \hline 2832 \end{array}$$

End of paper

Section II   Extra writing space

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

**Q 30
(e)**

$30 \times 12 \times 2592$

$= \$933\ 120$ (total paid over 30 years)

$277 \times (240 + 2592)$
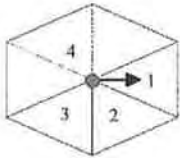
$= \$784\ 464$ (total paid over 23yrs 1 mth)

$\therefore$ saving difference

$933\ 120 - 784\ 464$

$\$148\ 660$

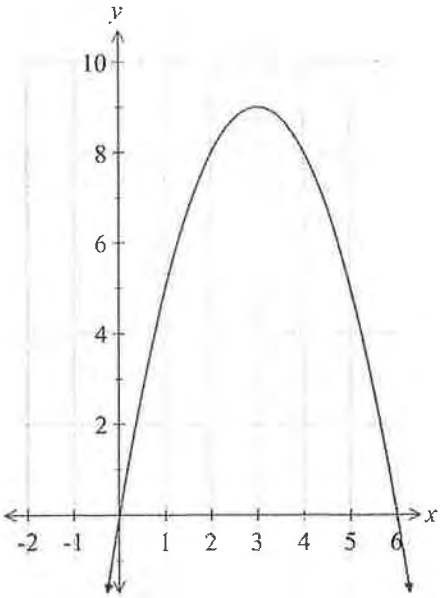|	
Old.	New.
loan $368 000	loan $368 000
total repay $= 30 \times 12 \times 2592$	total repay $= 277 \times (240 + 2592)$
$= \$933\ 120$	$= 784\ 464$
$\therefore$ interest paid $= 933\ 120 - 368000$	$\therefore$ total saved
$= \$565\ 120$	$933120 - 784464$
	$= \$148\ 656$

Section II

	Solution	Criteria
26(a) (i)	Arrangements $= 4 \times 4 = 16$ $\{11,12,13,14,21,22,23,24,31,32,33,34,41,42,43,44\}$	1 Mark: Correct answer.
26(a) (ii)	Hexagon is divided into 6 equilateral triangles. $P(2) = \dfrac{1}{6}$	1 Mark: Correct answer.
26(a) (iii)	$P(14) = \dfrac{1}{6} \times \dfrac{1}{2} = \dfrac{1}{12}$	1 Mark: Correct answer.
26(a) (iv)	Even number must end in a 2 or a 4. $P(\text{Even}) = \dfrac{4}{6} = \dfrac{2}{3}$	1 Mark: Correct answer.
26(b) (i)	$\angle BAC = 180° - 48°$ (C is due south of A) $\qquad = 132°$	1 Mark: Correct answer.
26(b) (ii)	$a^2 = b^2 + c^2 - 2bc \cos A$ $BC^2 = 85^2 + 101^2 - 2 \times 85 \times 101 \times \cos 132°$ $BC = 170.0440311...$ $\qquad \approx 170 \text{ km}$ The distance between the ships is 170 km.	2 Marks: Correct answer. 1 Mark: Substitutes one correct value into the cosine rule.
26(b) (iii)	$\dfrac{\sin C}{101} = \dfrac{\sin 132°}{170.0440311...}$ $\sin C = \dfrac{101 \times \sin 132°}{170.0440311...}$ $C = 26.19331292...$ $\qquad \approx 26°$ Bearing is 026° or N26°E	2 Mark: Correct answer in bearing or compass form. 1 Mark: a correct substitution & or correct answer not given as a bearing or compass direction
26(c)	Use z-scores to compare results First assessment task: $z = \dfrac{x - \bar{x}}{s} = \dfrac{66 - 82}{8} = -2$ Second assessment task: $z = \dfrac{x - \bar{x}}{s} = \dfrac{61 - 71}{10} = -1$ Jack has improved as his z-score has increased.	2 Marks: Correct answer. 1 Mark: Finds the z-score or shows some understanding.
26(d) (i)	$\mu = \dfrac{176 + 162 + 161 + 190 + 170}{5} = 171.8$ Population mean is 171.8	1 Mark: Correct answer.
26(d) (ii)	$^5C_2 = 10$ There are 10 possible samples.	1 Mark: Correct answer.

26(e)	$I = Prn$ $= \$1800 \times \dfrac{0.1975}{365} \times 15$ $= \$14.60958... \approx \$14.61$ Interest charged is \$14.61	2 Marks: Correct answer. 1 Mark: Converts to a daily rate or shows some understanding.
27(a) (i)	$A = lb$ $= 32 \times 18 = 576 \text{ m}^2$ Area of rectangle *ABCD* is 576 m^2	1 Mark: Correct answer.
27(a) (ii)	$A = \dfrac{h}{3}(d_f + 4d_m + d_l) + \dfrac{h}{3}(d_f + 4d_m + d_l)$ $= \dfrac{8}{3}(10 + 4 \times 7 + 6) + \dfrac{8}{3}(6 + 4 \times 7 + 10)$ $= 234.6666... \text{ cm}^2 \approx 235 \text{ m}^2$ Area of *PQCD* is approximately 235 m^2	2 Marks: Correct answer. 1 Mark: Makes some progress using Simpson's rule.
27(a) (iii)	$A = 576 - 235 - 156$ $= 185 \text{ m}^2$ Area of the garden bed is approximately 185 m^2	1 Mark: Correct answer.
27(b)	$c = \dfrac{k}{n}$ $\qquad\qquad$ $c = \dfrac{280}{n}$ $14 = \dfrac{k}{20}$ $\qquad\quad$ $= \dfrac{280}{15}$ $k = 280$ $\qquad\quad$ $= \$18.6666... \approx \$18.67$ Cost per passenger is \$18.67	2 Marks: Correct answer. 1 Mark: Finds the value of *k* or shows some understanding
27(c) (i)	Almost certainly – 99.7% of the scores. 3 standard deviations above and below the mean. $4.50 - 3 \times 0.03 = 4.41 \text{ cm}$ $4.50 + 3 \times 0.03 = 4.59 \text{ cm}$ Interval range is from 4.41 cm to 4.59 cm	1 Mark: Correct answer.
27(c) (ii)	The manager is concerned because 4.62 cm is 4 standard deviations above the mean. This is extremely unlikely to occur and indicates the machine is not working correctly.	1 Mark: Correct answer.
27(d) (i)	$12 - 7 = 5$ or $14 - 9 = 5$ 5 people had no change in blood pressure but had a reaction.	1 Mark: Correct answer.
27(d) (ii)	$91 + 14 = 105$ or $12 + 93 = 105$ 105 people were tested with the drug?	1 Mark: Correct answer.
27(d) (iii)	Percentage $= \dfrac{84}{105} \times 100$ $= 80\%$	2 Marks: Correct answer. 1 Mark: Used either 84 or 105

27(e) (i)	Total data used = 40 MB × 31 days = 1240 MB Included data = 1 GB = 1024 MB Excess data = 1240 − 1024 = 216 MB	1 Mark: Correct answer.
27(f)	(i) To draw the graph use the equation to obtain any two points. For example: $R = 0.2$ $S = -7.5 \times 0.2 + 10.8$ $\quad = 9.3$ Point (0.2 , 9.3) $R = 1$ $S = -7.5 \times 1 + 10.8$ $\quad = 3.3$ e.g. Point (1.0 , 3.3) Then plot the y-intercept (0, 10.8) and the above point to graph the line.	1 Mark: Correct answer.

Scatterplot of Reaction times

27(f)	(ii) When $S = 6$ $6 = -7.5R + 10.8$ $6 - 10.8 = -7.5R$ $-4.8 = -7.5R$ $R = \dfrac{-4.8}{-7.5}$ $\quad = 0.64$ $\quad = 0.6$ (nearest 10th sec) Or from reading off graph.	1 Mark: Correct answer.

28(a) (i)	Rock samples	Location A	Location B
	Minimum weight	15	27
	Lower quartile	32	46
	Median	40	57
	Upper quartile	47	61
	Maximum weight	62	73

2 Marks: Correct answer.

1 Mark: Two correct answers

28(a) (ii)	Location A weights show a normal distribution whereas location B the weights are negatively skewed. Location A the weights are generally lower, there is a smaller median (40 compared to 57) however the interquartile range from both locations is the same (IQR = 15).	2 Marks: Correct answer. 1 Mark: Shows some understanding.
28(b) (i)	Intersection value is 3.8077 (2% and 4 years) $PV = 3.8077 \times 3500$ $\quad = \$13,326.95$ Present value is \$13 326.95	1 Mark: Correct answer.
28(b) (ii)	Intersection value is 2.6730 (6% and 3 years) $\$17175 = x \times 2.6730$ $x = \dfrac{\$17175}{2.6730}$ $\quad = \$6425.364759... \approx \$6425$ Value of the annuity is \$6425 per year.	1 Mark: Correct answer.
28(b) (iii)	Intersection value is 3.6299 (4% and 4 years) $PV = 3.6299 \times 2000$ $\quad = \$7259.80$ Present value is \$7259.80	1 Mark: Correct answer.

28(c) (ii)	$3(4c-7)=3c$ $4c-7=c$ $3c-7=0$ $3c=7$ $c=\dfrac{7}{3}=2\dfrac{1}{3}$	$3(4c-7)=3c$ $12c-21=3c$ $9c-21=0$ $9c=21$ $c=\dfrac{21}{9}=2\dfrac{1}{3}$	1 Mark: Correct answer.
28(c) (iii)	$6\times\left(\dfrac{1}{6}x+\dfrac{1}{3}x\right)=12\times 6$ $x+2x=72$ $3x=72$ $x=24$	or $\dfrac{1}{6}x+\dfrac{1}{3}x=12$ $\dfrac{3}{6}x=12$ $3x=72$ $x=24$	2 Marks: Correct answer. 1 Mark: a correct step in solution
28(d)	Area $\triangle PQR=\dfrac{1}{2}\times14\times8$ $\qquad=56\ \text{cm}^2$ Area $\triangle PRS=\dfrac{1}{2}\times14\times15\times\sin59°$ $\qquad=90.00256657...\ \text{cm}^2$ Area $PQRS=56+90.00$ $\qquad=146.00\ \text{cm}^2$		2 Marks: Correct answer. 1 Mark: Finds the area of one triangle.
28(e)	Time difference $=8-1=7\ \text{h}$ Madrid is west of Beijing. Subtract the time difference. Madrid's time is 7.15 am - 7 h + 15 h = 3.15 pm 1$^{\text{st}}$ April		1 Mark: Correct answer.
28(f)	Draw the graph of $y=6x-x^2$ Maximum value of the quadratic function $y=6x-x^2$ is 9		2 Marks: Correct answer. 1 Mark: Draws a graph or table of values or makes some progress towards the solution.

29(a)(i)		1 Mark: Correct answer.

– do not draw line of best fit unless asked.

29(a)(ii)	$r = 0.9989200228...$ $\approx 0.9989 === 0.999 \quad (3 \text{ d.p.})$	1 Mark: Correct answer.

only 2 methods apply

29(a)(iii)	$A = 61.06$ $B = 0.3165714286... \approx 0.32 \rightarrow m = r \times \frac{\sigma y}{\sigma x}$ $y = Bx + A$ *easiest* $b = \bar{x} y's - m \times \bar{x} x's$ $= 0.32x + 61.06$ $\rightarrow \rightarrow$ Reg 1: $A = m$ $p = 0.32a + 61.06$ 2: $B = b$	2 Marks: Correct answer. 1 Mark: Finds A or B.

popular answer.
added d.b.
71.8

29(a)(iv)	$p = 0.32x + 61.06$ $= 0.32 \times 35 + 61.06$ $= 72.26$ Pulse rate is 72.26 beats per minute.	1 Mark: Correct answer.

or evidence of extrapolation on graph.

29(b)(i)	Angular distance $= 27 - 11$ $= 16°$	1 Mark: Correct answer.
29(b)(ii)	$l = \frac{16}{360} \times 2 \times \pi \times 6400$ $= 1787.217154...$ ≈ 1787 km Distance between Rossel Island and Brisbane is 1787 km.	1 Mark: Correct answer.
29(c)(i)	Life expectancy of a 25-year-old female is 59.33 years.	1 Mark: Correct answer.
29(c)(ii)	Difference $= 49.71 - 45.67$ $= 4.04$ Difference in life expectancy is 4.04 years.	1 Mark: Correct answer.

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29(d) (i)	Distance travelled in one year $= 800 \times 52 = 41600$ km Number of services $= \dfrac{41600}{10000} = 4.16 \approx 4$ Service cost $= 4 \times \$550$ $\qquad\qquad = \$2200$	2 Marks: Correct answer. 1 Mark: Finds the number of services in one year.
29(d) (ii)	Cost of petrol $= \dfrac{41600}{100} \times 10 \times \$1.50$ $\qquad\qquad = \$6240$	1 Mark: Correct answer.
29(d) (iii)	Total costs $= \$2200 + \$6240 + \$360 + \$540 + \$680$ $\qquad\qquad = \$10\ 020$	1 Mark: Correct answer.
29(e) (i)	Memory card $= \dfrac{16 \times 1024 \text{ MB}}{1.5}$ or 10922 whole photos $\qquad\qquad = 10,922.6666... \approx 10,923$ photos	1 Mark: Correct answer.
29(e) (ii)	Holiday $= 6 \times 7 \times 300$ $\qquad\quad = 12,600$ photos Number of memory cards $= \dfrac{12,600}{10,922.66...} = 1.1535644... \approx 2$ Two memory cards are needed for Joshua's holiday.	1 Mark: Correct answer.
30(a) (i)	To find the value of k substitute a value from the table. $\qquad L = km + 32$ $41.2 = 2k + 32$ $\quad 2k = 9.2$ $\qquad k = 4.6$	1 Mark: Correct answer.
30(a) (ii)	When no item is attached then $m = 0$ $L = 4.6m + 32$ $\quad = 4.6 \times 0 + 32 = 32$ The length of the spring is 32 cm.	1 Mark: Correct answer.
30(a) (iii)	To find m when $L = 78$ $\qquad L = 4.6m + 32$ $\quad 78 = 4.6m + 32$ $4.6m = 46$ $\qquad m = 10$ kg	1 Mark: Correct answer.
30(b) (i)	Number of arrangements $= 3 \times 2 \times 1$ $\qquad\qquad = 6$	1 Mark: Correct answer.
30(b) (ii)	Unordered selection Number of selections $= \dfrac{8 \times 7 \times 6}{3 \times 2 \times 1}$ or $^8C_3 = 56$ $\qquad\qquad = 56$	1 Mark: Correct answer.

30(c) (i)	$V = Ah$ $= (24 \times 12) \times 0.065$ $= 18.72 \text{ m}^3 \text{ or } 18.72 \text{ kL } (1 \text{ m}^3 = 1 \text{ kL})$ The barn roof collected 18.72 kL of water during the storm.	1 Mark: Correct answer.
30(c) (ii)	$V = \pi r^2 h$ $18.72 = \pi \times 2.5^2 \times h$ $h = \dfrac{18.72}{\pi \times 2.5^2}$ $= 0.9534017711...\text{m}$ $\approx 0.95 \text{ m or } 95 \text{ cm}$	2 Marks: Correct answer. 1 Mark: Substitutes at least one correct value into the volume formula.
30(c) (iii)	Height remaining $= 2 - 0.9534017711...$ $= 1.046598229...$ m $V = \pi r^2 h$ $= \pi \times 2.5^2 \times 1.0465982299...$ $= 20.54990817...$ m^3 $\approx 20,550 \text{ L} \quad (1 \text{ m}^3 = 1000 \text{ L})$ The tank can hold another 20,550 litres.	2 Marks: Correct answer. 1 Mark: Calculates the height remaining or shows some understanding of the problem.
30(d) (i)	$\dfrac{b}{a} = \dfrac{a}{c+8}$ $a^2 = b(c+8)$ $a = \pm\sqrt{b(c+8)}$	1 Mark: Correct answer.
30(d) (ii)	$a = \pm\sqrt{b(c+8)}$ $= \pm\sqrt{4 \times (1+8)}$ $= \pm 6$	1 Mark: Correct answer.
30(e) (i)	Total paid $= \$2592 \times 30 \times 12$ $= \$933\ 120$ Interest $= \$933\ 120 - \$368\ 000$ $= \$565\ 120$ Interest paid is \$565 120	1 Mark: Correct answer.
30(e) (ii)	Charlotte pays \$2832 per month for 277 months. Total paid $= \$2832 \times 277$ $= \$784\ 464$ Interest saving $= \$933\ 120 - \$784\ 464$ $= \$148\ 656$ Interest saved is \$148 656	2 Marks: Correct answer. 1 Mark: Calculates the total paid or shows some understanding.