

2014 HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics General 2**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.

Extra writing space is provided on
pages 33 and 34. If you use this space,
clearly indicate which question you
are answering.

Please turn over

Question 26 (15 marks)

- (a) Expand
- $4x(7x^4 - x^2)$
- .

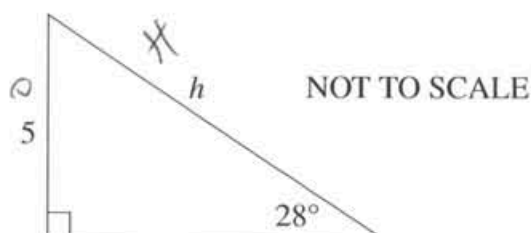
1

$$28x^5 - 4x^3$$

$$32x^8$$

- (b) Calculate the value of
- h
- correct to two decimal places.

2



$$\sin 28^\circ = \frac{5}{h} = 2.34735$$

$$= 2.35$$

$h = 2.35$

- (c) Solve the equation
- $\frac{5x+1}{3} - 4 = 5 - 7x$
- .

3

$$\frac{5x+1}{3} - 4 = 5 - 7x$$

$$5x + 1 - 12 = 15 - 21x$$

$$16x - 11 = 15$$

$$16x = 26$$

$$x = \frac{26}{16} = 1.625$$

Question 26 continues on page 15

Question 26 (continued)

- (d) Solve these simultaneous equations to find the values of
- x
- and
- y
- .

3

$$y = 2x + 1$$

$$x - 2y - 4 = 0$$

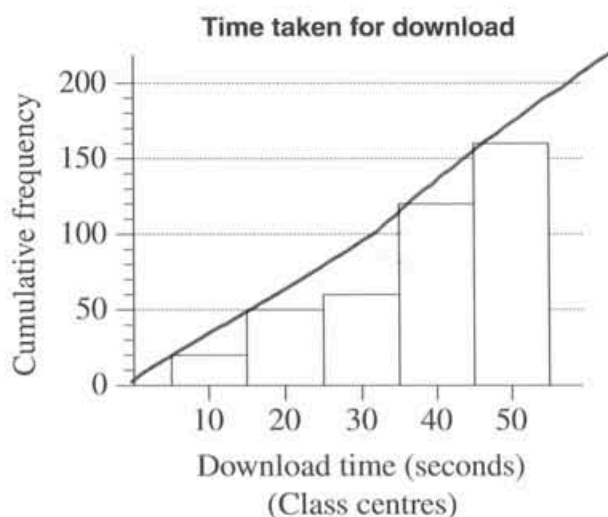
$$y = x$$

$$x - 2y - 4 = 0$$

$$= x - 2x - 4 = 0$$

- (e) The times taken for 160 music downloads were recorded, grouped into classes and then displayed using the cumulative frequency histogram shown.

2



On the diagram, draw the lines that are needed to find the median download time.

Question 26 continues on page 16

Question 26 (continued)

- (f) The weight of an object on the moon varies directly with its weight on Earth. An astronaut who weighs 84 kg on Earth weighs only 14 kg on the moon.

2

A lunar landing craft weighs 2449 kg when on the moon. Calculate the weight of this landing craft when on Earth.

$$84 - 14 = 70 \text{ kg}$$

$$2449 + 70 = 2519 \text{ kg.}$$

Question 26 continues on page 17

Question 26 (continued)

- (g) Singapore is located at 1°N 104°E and Sydney is located at 34°S 151°E .

2

What is the time difference between Singapore and Sydney? (Ignore daylight saving.)

9 hours.

End of Question 26

Please turn over

Question 27 (15 marks)

- (a) Alex is buying a used car which has a sale price of \$13 380. In addition to the sale price there are the following costs:

Transfer of registration

\$30

Stamp Duty

\$399

1 1111111111
2 1111111111
3 1111111111
4 1111111111
5 1111111111

- (i) Stamp Duty for this car is calculated at \$3 for every \$100, or part thereof, of the sale price. 1

Calculate the Stamp Duty payable.

$$150 \times 150 = 10000$$

$$90 + 9 = 99$$

$$150 + 150 + 99 = 399$$

- (ii) Alex borrows the total amount to be paid for the car including Stamp Duty and transfer of registration. Interest on the loan is charged at a flat rate of 7.5% per annum. The loan is to be repaid in equal monthly instalments over 3 years. 4

Calculate Alex's monthly repayments.

$$13\,380 + \$30 + \$399 = \$13809$$

$$13809 (1 + 0.075)^{36}$$

After 3 years

Total amount paid.

$$\$14\,768.17$$

Question 27 continues on page 19

Question 27 (continued)

- (iii) Alex wishes to take out comprehensive insurance for the car for 12 months. The cost of comprehensive insurance is calculated using the following: 3

| | |
|-------------------------|--|
| Base rate | \$845 |
| Fire Service Levy (FSL) | 1% of base rate |
| Stamp Duty | 5.5% of the total of base rate and FSL |
| GST | 10% of the total of base rate and FSL. |

Find the total amount that Alex will need to pay for comprehensive insurance.

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- (iv) Alex has decided he will take out the comprehensive car insurance rather than the less expensive non-compulsory third-party car insurance. 1

What extra cover is provided by the comprehensive car insurance?

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Question 27 continues on page 20

Question 27 (continued)

- (b) Xuso is comparing the costs of two different ways of travelling to university.

2

Xuso's motorcycle uses one litre of fuel for every 17 km travelled. The cost of fuel is \$1.67/L and the distance from her home to the university car park is 34 km. The cost of travelling by bus is \$36.40 for 10 single trips.

Which way of travelling is cheaper and by how much? Support your answer with calculations.

Home to uni uses 2 L of fuel
 $= \$3.34$ A Day. $\$3.34 \times 5 = \16.70

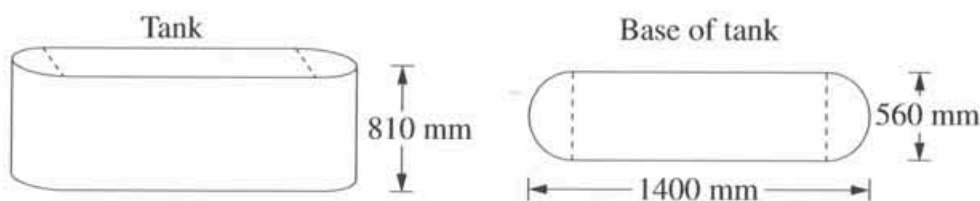
$10 \div 36.40 = \$3.64$ a day.

Driving is cheaper by 30c

- (c) The base of a water tank is in the shape of a rectangle with a semicircle at each end, as shown.

4

The tank is 1400 mm long, 560 mm wide, and has a height of 810 mm.



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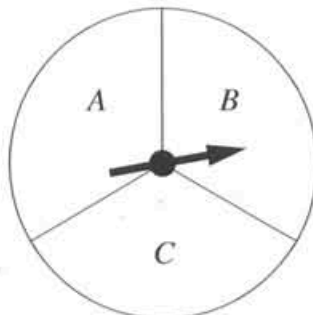
What is the capacity of the tank, to the nearest litre?

810 mm
 1400 mm
 560 mm
 $\approx 560L$

End of Question 27

Question 28 (15 marks)

- (a) James plays a game involving a spinner with sectors of equal size labelled A, B and C, as shown. 2



He pays \$2 to play the game. He wins \$5 if the spinner stops in A and 50 cents if it stops in B or C.

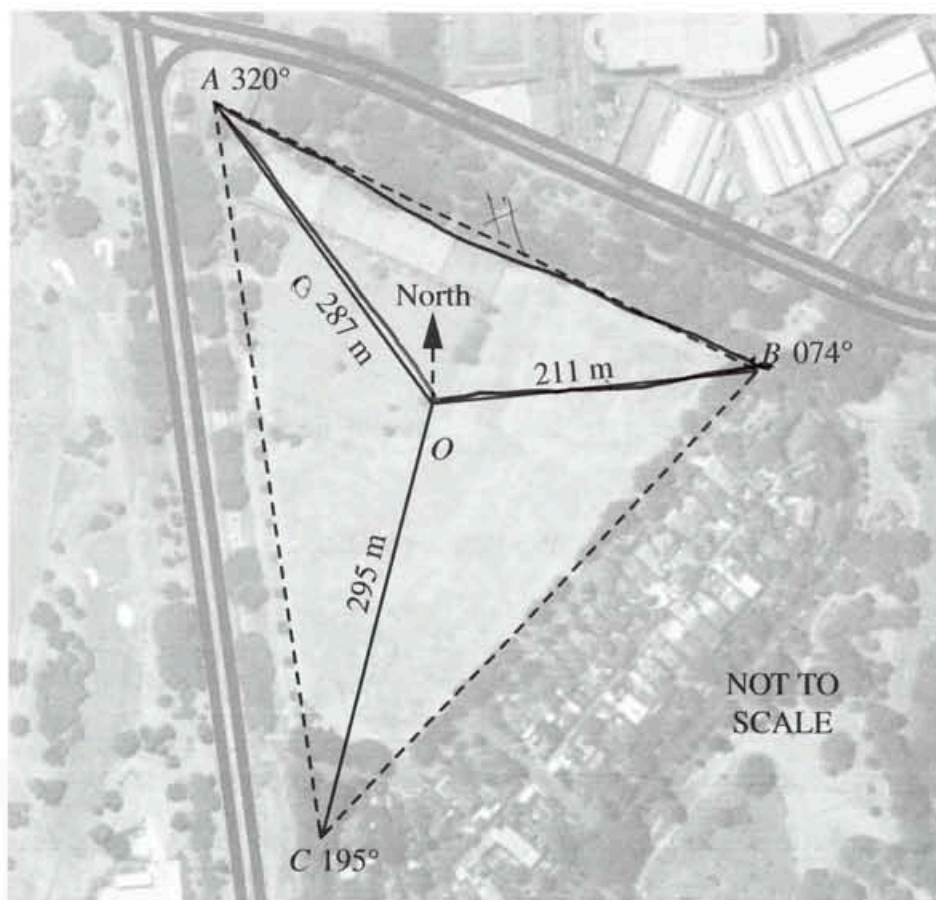
Calculate James's financial expectation for the game.

$$\frac{1}{3} = A \quad \frac{1}{3} = B \quad \frac{1}{3} = C$$

~~possibility of~~ probability of
James financial expectation
is \$ 50c, more likely to
stop B or C for the
Question 28 continues on page 22 given Newland.

Question 28 (continued)

- (b) A radial compass survey of a sports centre is shown in the diagram.



- (i) Show that the size of angle AOB is 114° .

1

Sumner

$$\tan 320^\circ = \frac{287}{211}$$

Question 28 continues on page 23

Question 28 (continued)

- (ii) Calculate the length of the boundary
- AB
- , to the nearest metre.

2

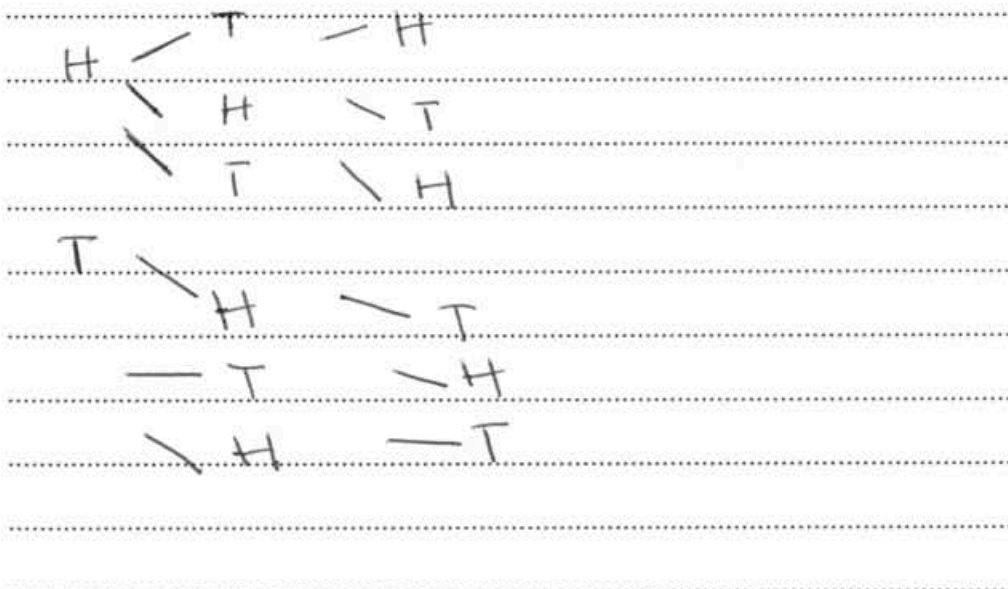
$$287 + 211 = 498 \text{ m.}$$

- (iii) Find the area of triangle
- AOB
- in hectares, correct to two significant figures.

3

- (c) A fair coin is tossed three times. Using a tree diagram, or otherwise, calculate the probability of obtaining two heads and a tail in any order.

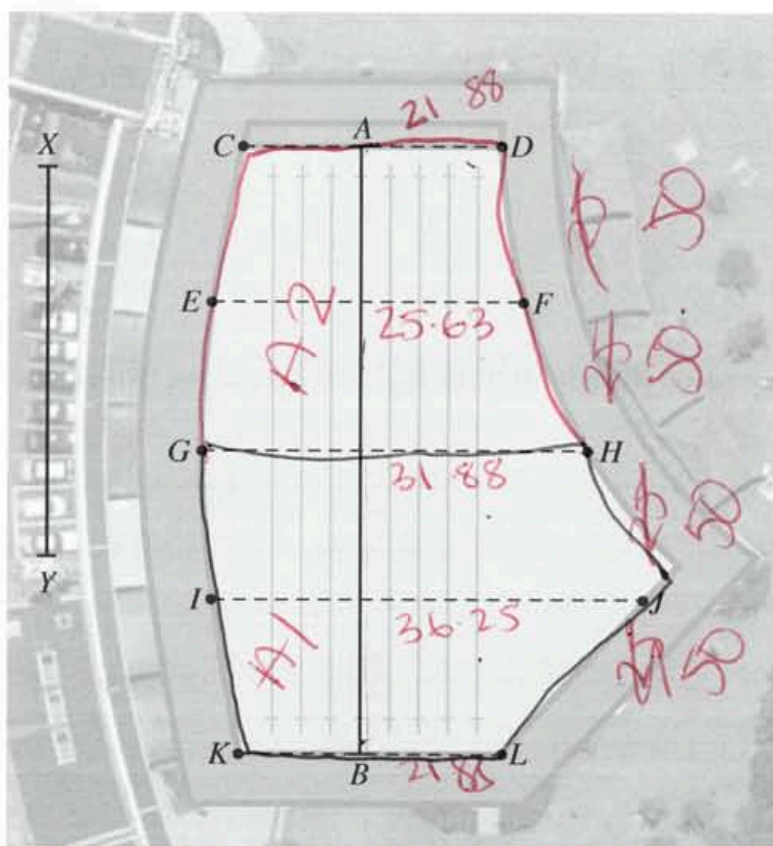
2



Question 28 continues on page 24

Question 28 (continued)

- (d) An aerial diagram of a swimming pool is shown.



The swimming pool is a standard length of 50 metres but is not in the shape of a rectangle.

- (i) By measuring the length AB , determine the scale of the diagram.

1

80 cm

$$1 \text{ cm} = 80 \text{ m}$$

- (ii) Using this scale, calculate the length XY of the car park, in metres.

1

55 m

Question 28 continues on page 25

Question 28 (continued)

- (iii) In the diagram of the swimming pool, the five widths are measured to be:

3

$CD = 21.88 \text{ m}$

$EF = 25.63 \text{ m}$

$GH = 31.88 \text{ m}$

$IJ = 36.25 \text{ m}$

$KL = 21.88 \text{ m}$

$$A \approx \frac{n}{3} (a + 4 \times d + b)$$

The average depth of the pool is 1.2 m.

Calculate the approximate volume of the swimming pool, in cubic metres. In your calculations, use TWO applications of Simpson's Rule.

$$A1 = \frac{50}{3} (21.88 + 4 \times 36.25 + 31.88)$$
$$\approx 3312.6 \text{ m}^2$$

$$A2 \approx \frac{50}{3} (31.88 + 4 \times 25.63 + 21.88)$$
$$\approx 2604.6 \text{ m}^2$$

$$\text{approx } \uparrow 3312.6 + 2604.6$$
$$\uparrow 5917.2 \text{ m}^2$$

End of Question 28

Question 29 (15 marks)

- (a) The cost of hiring an open space for a music festival is \$120 000. The cost will be shared equally by the people attending the festival, so that C (in dollars) is the cost per person when n people attend the festival.

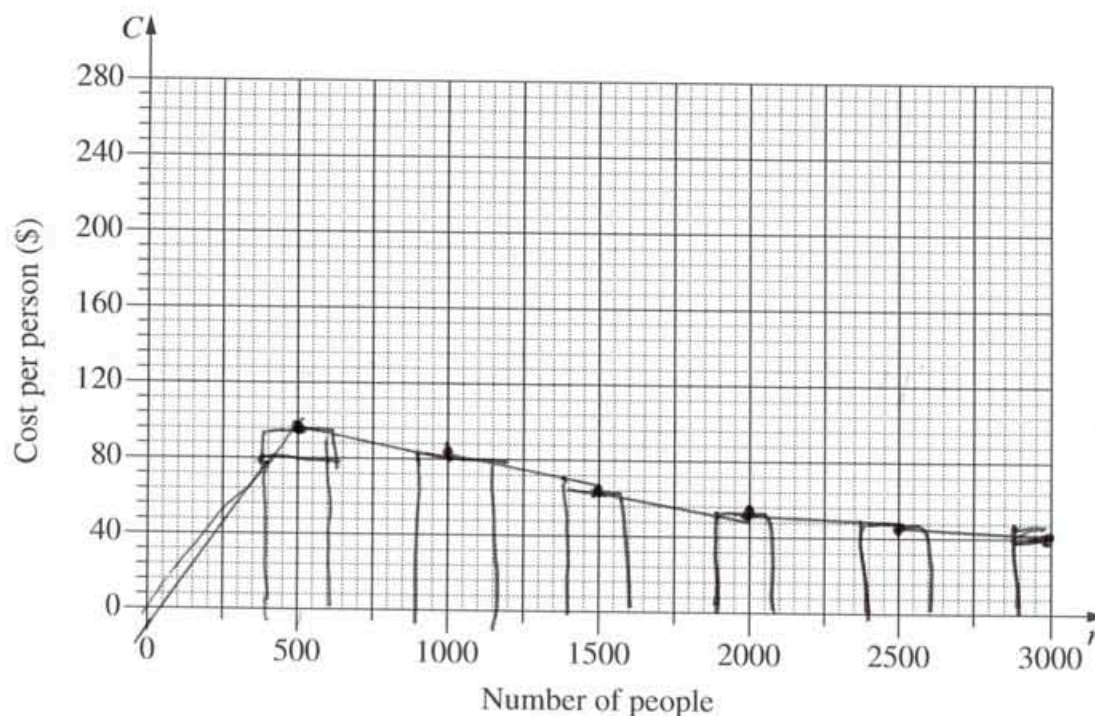
- (i) Complete the table below by filling in the THREE missing values.

1

| Number of people (n) | 500 | 1000 | 1500 | 2000 | 2500 | 3000 |
|-----------------------------|-----|------|------|------|------|------|
| Cost per person (C) | 96 | 84 | 72 | 60 | 48 | 40 |

- (ii) Using the values from the table, draw the graph showing the relationship between n and C .

2



- (iii) What equation represents the relationship between n and C ?

1

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Question 29 continues on page 27

Question 29 (continued)

- (iv) Give ONE limitation of this equation in relation to this context.

1

less number of people
increases per persons.

- (v) Is it possible for the cost per person to be \$94? Support your answer with appropriate calculations.

1

yes the less amount of
people the cost per
person increases
to \$94.

- (b) What is the maximum number of standard drinks that a male weighing 84 kg can consume over 4 hours in order to maintain a blood alcohol content (BAC) of less than 0.05?

3

A male weighing 84kg
can only have a standard
drink one per hour
in order to maintain
blood alcohol content.

Question 29 continues on page 28

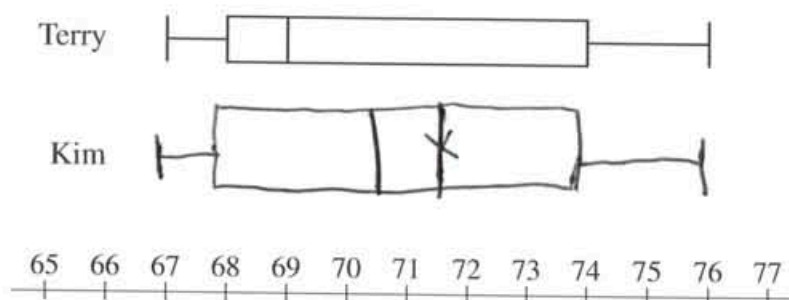
Question 29 (continued)

- (c) Terry and Kim each sat twenty class tests. Terry's results on the tests are displayed in the box-and-whisker plot shown in part (i).

- (i) Kim's 5-number summary for the tests is 67, 69, 71, 73, 75.

1

Draw a box-and-whisker plot to display Kim's results below that of Terry's results.



- (ii) What percentage of Terry's results were below 69?

1

23%

- (iii) Terry claims that his results were better than Kim's. Is he correct? Justify your answer by referring to the summary statistics and the skewness of the distributions.

4

Kim's results were higher
as she had a 5
number summary.

End of Question 29

Question 30 (15 marks)

- (a) Chandra and Sascha plan to have \$20 000 in an investment account in 15 years time for their grandchild's university fees.

3

The interest rate for the investment account will be fixed at 3% per annum compounded monthly.

Calculate the amount that they will need to deposit into the account now in order to achieve their plan.

$$20000(1 + 0.03)^{0.12}$$

$$=$$

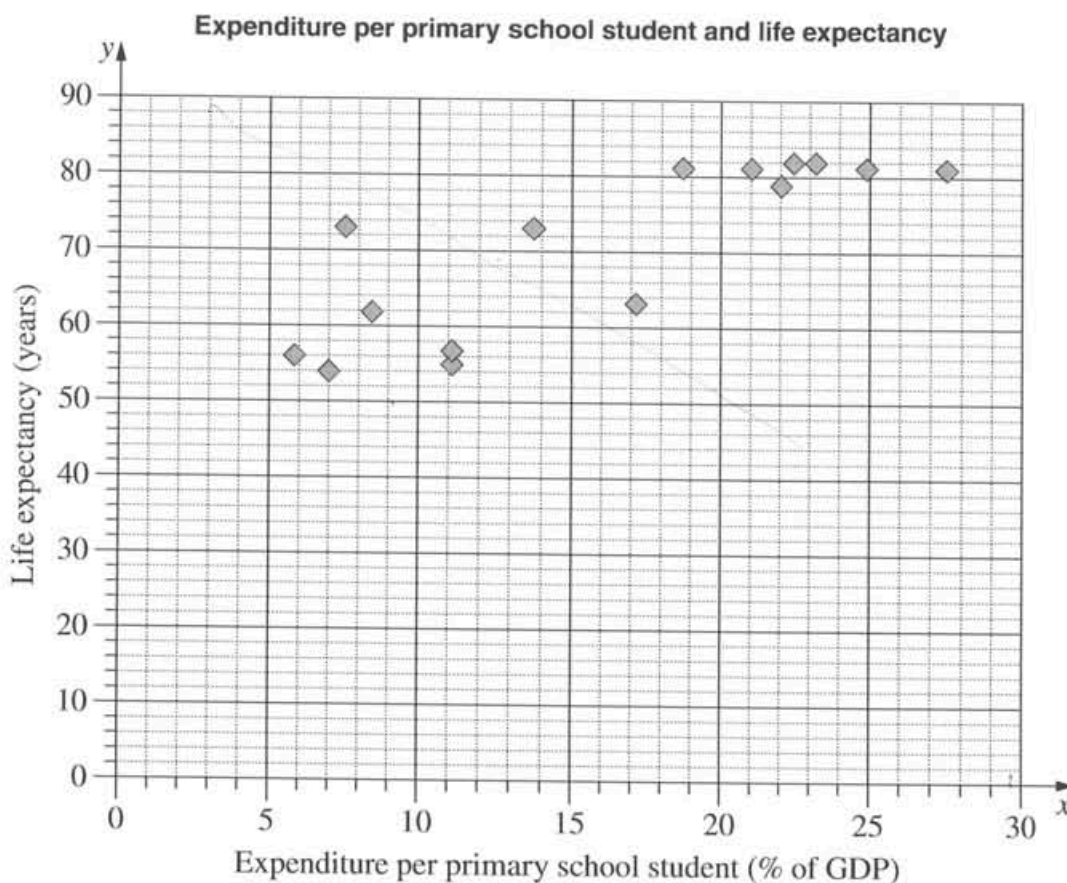
$$20000(1 + 0.03)^{15}$$

$$= \$31\,159.34$$

Question 30 continues on page 30

Question 30 (continued)

- (b) The scatterplot shows the relationship between expenditure per primary school student, as a percentage of a country's Gross Domestic Product (GDP), and the life expectancy in years for 15 countries.



- (i) For the given data, the correlation coefficient, r , is 0.83. What does this indicate about the relationship between expenditure per primary school student and life expectancy for the 15 countries?

1

student age increase the
life expectancy
increase too.

Question 30 continues on page 31

Question 30 (continued)

- (ii) For the data representing expenditure per primary school student, Q_L is 8.4 and Q_U is 22.5. 1

What is the interquartile range?

12.6

- (iii) Another country has an expenditure per primary school student of 47.6% of its GDP. Would this country be an outlier for this set of data? Justify your answer with calculations. 2

- (iv) The expenditures per primary school student for the 15 countries in the scatterplot are: 2

5.9, 7, 7.6, 8.4, 11.2, 11.2, 13.7, 17.1, 18.7, 21.1, 22, 22.5, 23.2, 24.9, 27.6

Complete the table below by calculating the mean, \bar{x} , and the standard deviation, σ_x , of these data. Calculate both values to two decimal places.

The table also shows the mean, \bar{y} , and the standard deviation, σ_y , of life expectancy for the same 15 countries.

| | Mean | Standard deviation |
|--|-------------------|--------------------|
| Expenditure per primary school student | $\bar{x} = 19.63$ | $\sigma_x =$ |
| Life expectancy | $\bar{y} = 70.73$ | $\sigma_y = 10.94$ |

Question 30 continues on page 32

Question 30 (continued)

- (v) Using the values from the table in part (iv), show that the equation of the least-squares line of best fit is 2

$$y = 1.29x + 49.9.$$

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- (vi) On the scatterplot on page 30, draw the least-squares line of best fit, $y = 1.29x + 49.9$. 2

- (vii) Using this line, or otherwise, estimate the life expectancy in a country which has an expenditure per primary school student of 18% of its GDP. 1

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- (viii) Why is this line NOT useful for predicting life expectancy in a country which has expenditure per primary school student of 60% of its GDP? 1

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Section II extra writing space

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