

## 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.

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**Please turn over**

SOH  
CAH  
TAH

## Question 26 (15 marks)

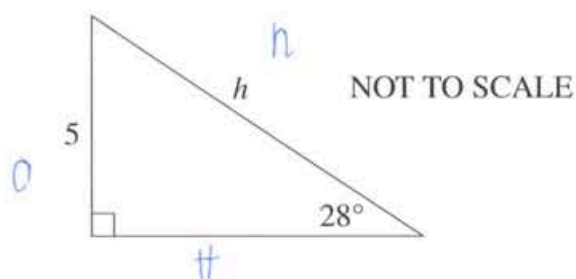
- (a) Expand
- $4x(7x^4 - x^2)$
- .

1

$$\begin{aligned} & \cancel{4x^5} + 28x^5 - 4x^3 \\ & = 24x^5 \end{aligned}$$

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

2



$$\begin{aligned} \sin 28 &= \frac{5}{h} \\ 5 \times \sin 28 &= 2.35 \end{aligned}$$

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

3

$$\begin{aligned} \frac{5x+1}{3} - 4 &= 5 - 7x \\ 5x+1-4 &= 15-7x \\ 5x+1 &= 15-7x \\ 15+4 & \\ 5x+1 &= 19-7x \\ 19-1 &= 18 \\ 5x &= 18-7x \\ 18-7 &= 11x \quad \cancel{5x} = 11x-5 = x = 6 \\ -5 & \end{aligned}$$

Question 26 continues on page 15

Question 26 (continued)

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

3

$$y = 2x + 1$$

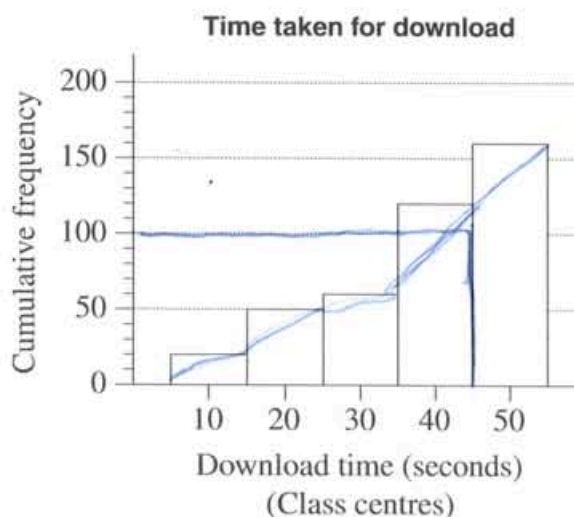
$$x - 2y - 4 = 0$$

Handwritten work for part (d):

$$\begin{aligned}
 & \cancel{x - 2(2x + 1) - 4 = 0} & \cancel{x - 2(2x + 1) - 4 = 0} \\
 & \cancel{x - 2 \cdot 3x - 4 = 0} & \cancel{2x - 2 \cdot 3x - 4 = 0} \\
 & \cancel{x = 2 \cdot 3x + 1} & \\
 & x - 2(2 + 1) - 4 = 0 & x = 2y \\
 & 3 - 4 & \\
 & x - 2 \cdot -1 = 0 & 2y \\
 & 2x - 1 = 0 & \\
 & 1x = 0 & y = 2x + 1 \\
 & \textcircled{x = 1} & y = 2 \cdot 1 + 1 \\
 & & \textcircled{y = 3}
 \end{aligned}$$

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

2



Handwritten notes:

mode =  $M_0$   
 Mean =  $\bar{x}$   
 range =  $hig - low$   
 M

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

Question 26 continues on page 16

## Question 26 (continued)

70

- (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 moon

70 kg

2449 - 2379 kg on the moon

Question 26 continues on page 17

## Question 26 (continued)

- (g) Singapore is located at  $1^{\circ}\text{N}$   $104^{\circ}\text{E}$  and Sydney is located at  $34^{\circ}\text{S}$   $151^{\circ}\text{E}$ .

2

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

1°N 104°E 34°S 151°E

$$104 + 151$$

$$255 \times 4 = 876 \text{ minutes}$$

$$876 \div 60 \text{ minutes} = 14 \text{ hours } 6 \text{ minutes}$$

End of Question 26

Please turn over





## 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.

$$\begin{aligned} \frac{0.01}{100} \times 845 &= 0.0845 \\ &= \$8.45 \\ \frac{0.05}{100} \times 845 &= 0.4225 \\ &= \$42.25 \\ \frac{0.10}{100} \times 845 &= 0.845 \\ &= \$84.5 \\ &= \$135.2 \end{aligned}$$

- (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?

It doesn't have a fire service levy.

Question 27 continues on page 20

## Question 27 (continued)

- (b) Xuso is comparing the costs of two different ways of travelling to university. 2

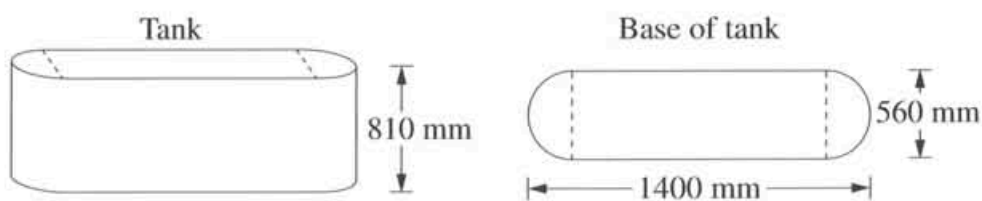
Xuso's motorcycle uses one litre of fuel for every 17 km travelled. The cost of fuel is \$1.67/L and the distance from her home to the university car park is 34 km. The cost of travelling by bus is \$36.40 for 10 single trips.

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

$$\begin{aligned}
 1\text{L} \times 17 &= 17\text{L} & 17\text{L} \times \$1.67 &= \$28.39 \\
 34 \div 17 &= 2 \\
 \text{Motorcycle} &= 28.39 \times 2 \\
 &= 56.78 \\
 \text{Bus is cheaper by } & \$20.38
 \end{aligned}$$

- (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.



NOT TO SCALE

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

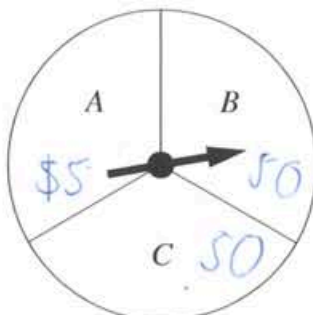
$$\begin{aligned}
 A \times H & \text{ rectangle} \\
 L \times & \\
 1400 \times 560 \times 810 & \\
 &= 635040000 \\
 4 \times \pi \times 280^2 &= 985203.4562 \times 2 \\
 \text{sphere} \times 2 &= 1970406.912 \\
 &= 637010\text{L}
 \end{aligned}$$

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.

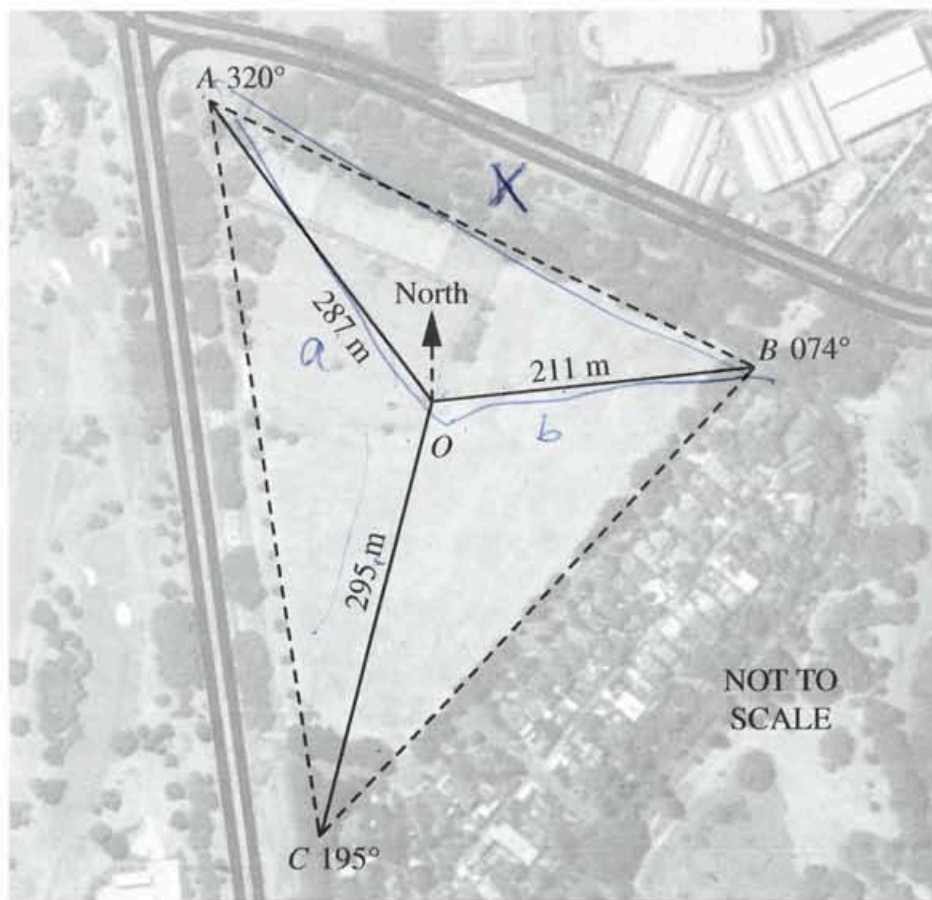
$$\left(\frac{5}{120} \times 2\right) + \left(\frac{0.50}{120} \times 2\right) + \left(\frac{0.50}{120} \times 2\right)$$

$$= \$0.1$$

**Question 28 continues on page 22**

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  $114^\circ$ .

$$\begin{aligned} & \text{BC} = 211 \times 295 \times \sin(74^\circ) \\ & \frac{287 \times 211 \times \sin(74^\circ)}{287 \times 211} = 114^\circ \end{aligned}$$

Question 28 continues on page 23

Question 28 (continued)

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

2

$$\frac{287}{211}$$

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

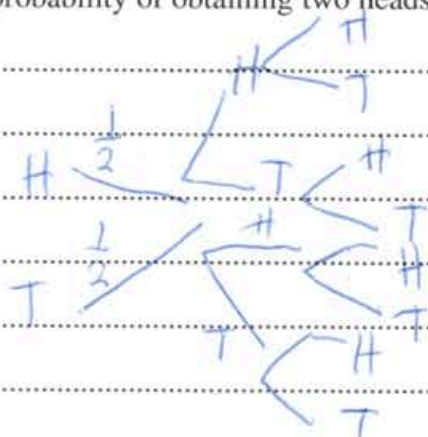
3

$$\frac{1}{2} \times 287 \times 211 \times \sin(74)$$

$$= 29105.56$$

- (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

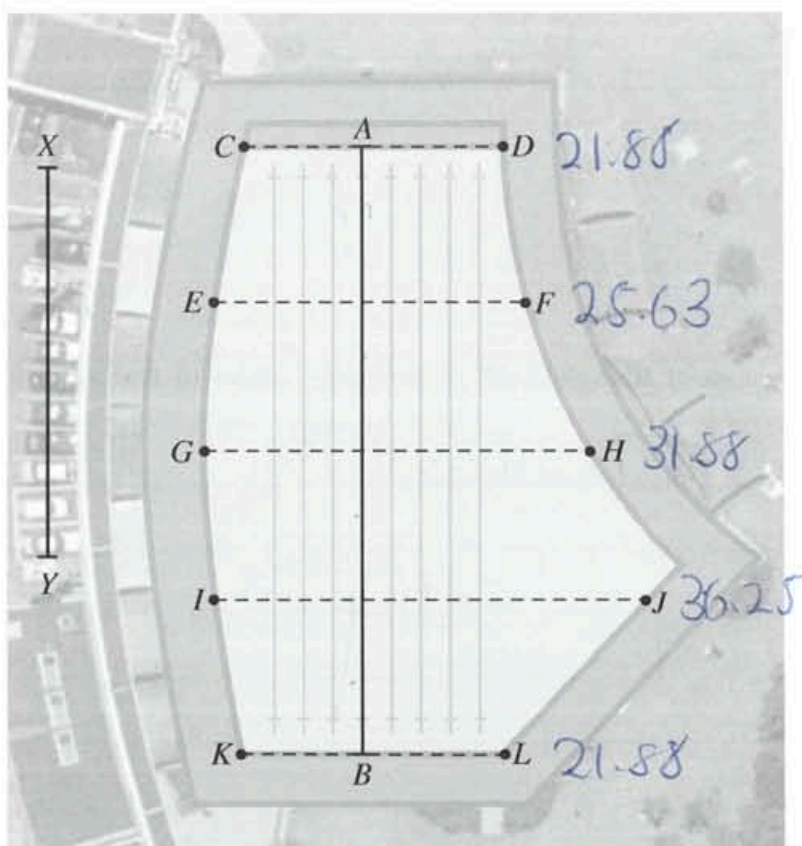


$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8} \text{ chance.}$$

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

$58 \quad 2 \text{ cm} \times 4 = 8$

1 cm = 70 m

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

1

$5 \text{ cm} \times 100 = 500 \text{ m}$

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

$$CD = 21.88 \text{ m}$$

$$EF = 25.63 \text{ m}$$

$$GH = 31.88 \text{ m}$$

$$IJ = 36.25 \text{ m}$$

$$KL = 21.88 \text{ m}$$

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.

$$\frac{1.2}{3} (21.88 + 4 \times 25.63 + 31.88) = 0.0026$$

$$\frac{1.2}{3} (31.88 + 4 \times 36.25 + 21.88) = 0.0026$$

**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.

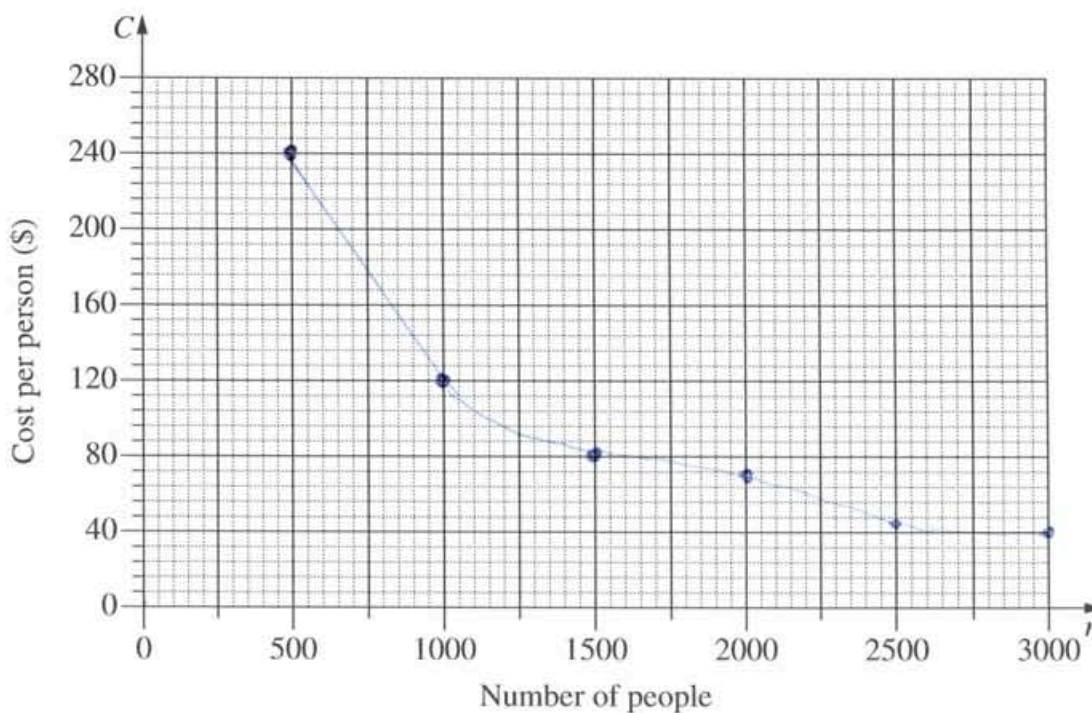
- (i) Complete the table below by filling in the THREE missing values.

1

Number of people ( $n$ )	500	1000	1500	2000	2500	3000
Cost per person ( $C$ )	240	120	80	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

$n \times C = 120000$

Question 29 continues on page 27

## Question 29 (continued)

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

1

does always go

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

1

no because it would be half a person.

- (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

84 kg

$$\frac{10 \times N - 7.5 \times 4}{6.8 \times 84}$$

$$\frac{10 \times N - 7.5 \times 4}{571.2}$$

$$\frac{10 \times N - 30}{571.2}$$

$$\frac{-300}{571.2}$$

5 drinks

Question 29 continues on page 28

~~67 69 71 73 75~~  
~~73 75~~

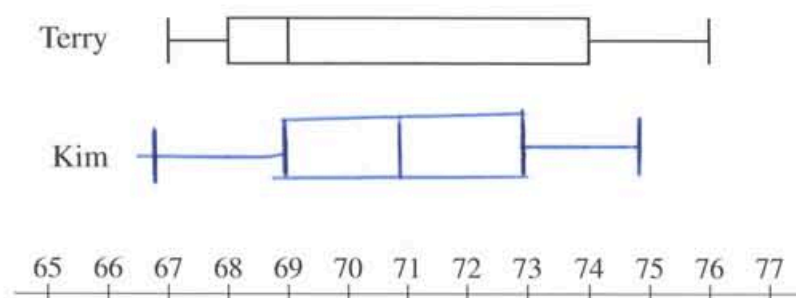
Question 29 (continued)

- (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

10%

- (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

Yes Terry had a more of a positive skewness to his graph box-and-whisker plot. He scored high than Kim in his test eg 76.

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.

$$\frac{20\,000(1+0.03)^{180}}{12} = \$31\,384.63$$

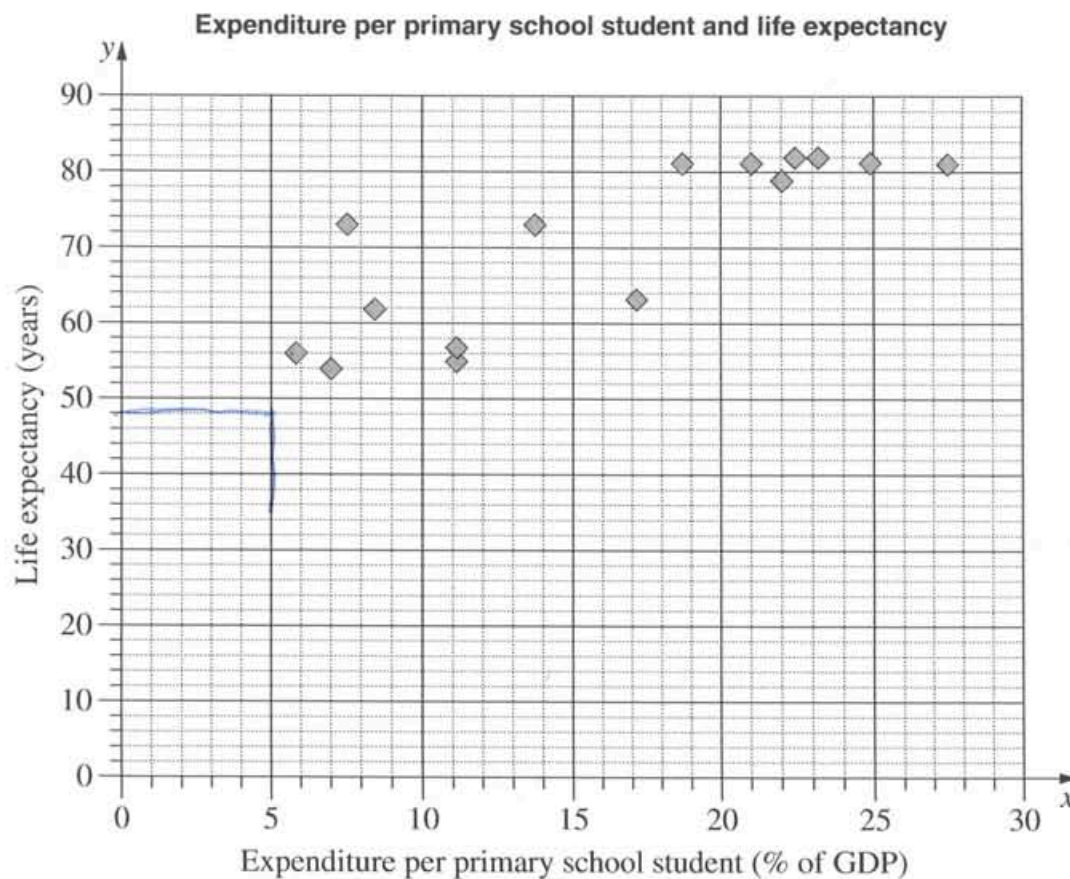
$$20\,000 = 31\,384.63$$

$$= \$11\,384.63$$

**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

That 0.83 are expenditure per primary school as well as 0.83 life expectancy in different countries.

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?

$22.5 - 8.4$   
 $= 14.1$

- (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

yes it would be an outlier.  
 $\frac{47.6}{30}$

- (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,  $\sigma_x$ , of these data. Calculate both values to two decimal places.

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

	Mean	Standard deviation
Expenditure per primary school student	$\bar{x} = 16.14$	$\sigma_x = 2.3$
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

$$y = 1.29x + 49.9.$$

$$1.29 \times 16.14 + 49.9$$

$$= 70.7206$$

- (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

83 life expectancy

- (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

Because its accurate and it can change at any time.

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