

Surname	SOLNS	Centre Number	Candidate Number
Other Names			0



GCSE – NEW

3300U40-1



SOLUTIONS

**MATHEMATICS
UNIT 2: CALCULATOR-ALLOWED
INTERMEDIATE TIER**

THURSDAY, 10 NOVEMBER 2016 – MORNING

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Take π as 3.14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question 9, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	4	
2.	3	
3.	3	
4.	5	
5.	3	
6.	3	
7.	4	
8.	2	
9.	6	
10.	6	
11.	7	
12.	3	
13.	4	
14.	6	
15.	5	
16.	4	
17.	5	
18.	7	
Total	80	

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01



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1. Using only the numbers in the following list,

57 58 59 60 61 62 63 64 65

write down

- (a) a prime number, — can only be $\div$ by 1 and the number itself [1]

61. or 59

- (b) a cube number, [1]

64

$$4^3 = 4 \times 4 \times 4$$

- (c) a factor of 186, [1]

62

$$62 \times 3 = 186$$

- (d) a multiple of 7.25. [1]

~~66~~ 58

$$7.25 \times 2 =$$

~~$$7.25 \times 2 = 14.5$$~~

$$\text{and } 14.5 \times 4 = 58$$

$$\text{so } 7.25 \times 8 = 60$$

2. Circle the correct answer for each of the following statements.

- (a) One angle in a right-angled triangle is 60° .
One of the other angles must be

180°

30°

120°

60°

360°

[1]

$$180 - 90 = 90$$

- (b) Three of the angles in a quadrilateral add up to 250° .
The size of the fourth angle is

70°

360°

180°

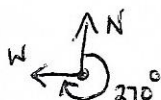
110°

125.5°

[1]

$$360 - 250$$

- (c) Huw is facing North.
He turns **clockwise** until he is facing West.
He has turned through an angle of



270°

3°

90°

0.75°

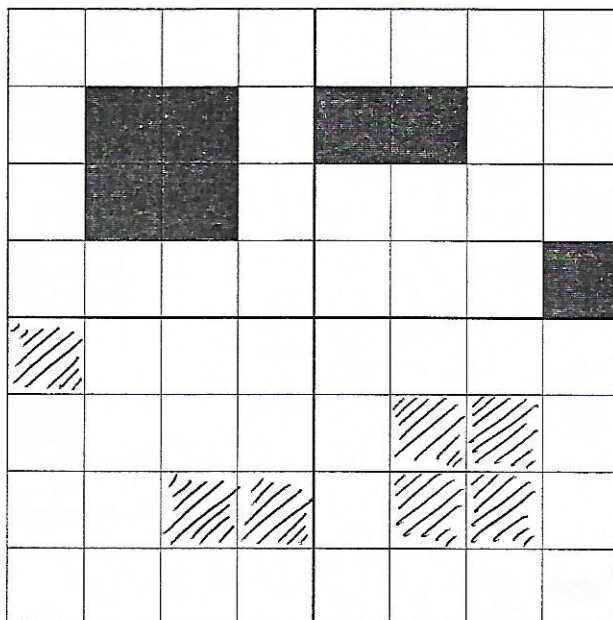
9°

[1]



3. Shade the least number of squares in the lower two quadrants so that the grid has rotational symmetry of order 2. [3]

↗ This means the picture will be the same upside down



4. (a) Solve the equation $3x - 2 = 10$. [2]

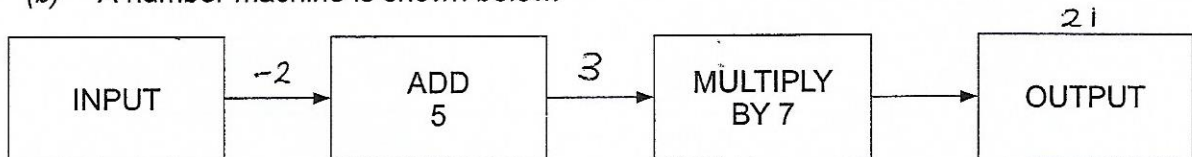
$$3x = 10 + 2$$

$$3x = 12$$

$$x = \frac{12}{3}$$

$$x = 4$$

- (b) A number machine is shown below.



- (i) Calculate the OUTPUT when the INPUT is -2 . [1]

$$-2 + 5 = 3$$

$$\text{OUTPUT} = 21$$

$$3 \times 7 = 21$$

- (ii) Write down an expression for the OUTPUT when the INPUT is n . [2]

$$7(n + 5)$$

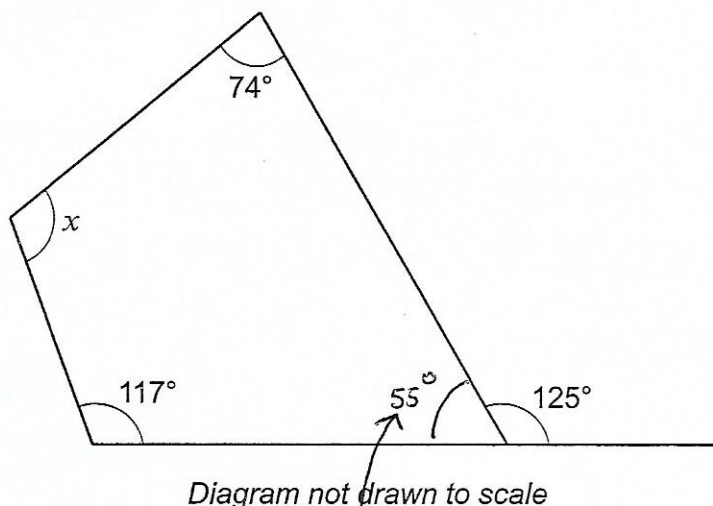


5. Complete each row of the following table.
The first row has been done for you.

[3]

Place	Temperature at midday	Change	Temperature at following midday
Holyhead	-1°C	Up 3°C	2°C
Dolgellau	-3°C	Up 4°C	1°C
Cardigan	2°C	Down 3°C	-1°C
Newport	-4°C	Up 2°C	-2°C

6.

Find the size of angle x .

[3]

first $180 - 125 = 55^{\circ}$

Now angles in a quad add up to 360°

$$117 + 74 + 55 = 246^{\circ}$$

$$\therefore 360 - 246 = 114^{\circ}$$

$$x = 114^{\circ}$$



7. Show clearly whether the following statement is true or false. [4]

'If you increase a positive number by 10% and then decrease that new value by 10%, you get back to your original number.'

Let the starting number be x

$$\text{Increase } x \text{ by } 10\% = x \times 1.10 = 1.10x$$

$$\begin{aligned} \text{Now Decrease } 1.10x \text{ by } 10\% \\ = 1.10x \times 0.90 \end{aligned}$$

$$= 0.99x \quad \text{So you don't get back to } x.$$

∴ The statement is false.

8. Circle either TRUE or FALSE for each statement given below. [2]

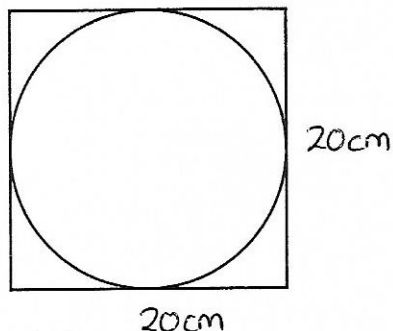
STATEMENT		
All equilateral triangles are congruent.	TRUE	<u>FALSE</u>
All squares with equal areas are congruent.	<u>TRUE</u>	FALSE
Circles with equal perimeters are congruent.	<u>TRUE</u>	FALSE
All regular octagons are congruent.	TRUE	<u>FALSE</u>



9. In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.

A square has a perimeter of 80 cm.

A circle fits exactly inside the square, as shown in the diagram.



Calculate the circumference of the circle.

Give your answer correct to 1 decimal place.

You must show your working.

[4 + 2 OCW]

$$\text{Square Perimeter} = 80\text{cm}$$

$$\text{Each side} = \frac{80}{4} = 20\text{cm}$$

$$\text{Now Circle : Diameter} = 20\text{cm}$$

$$C = \pi D$$

$$C = 3.14 \times 20$$

$$C = 62.8\text{cm}$$



10. (a) Write down the n th term of the following sequence. [2]

3, $\xrightarrow{+1}$ 4, $\xrightarrow{+1}$ 5, $\xrightarrow{+1}$ 6,

$$1n + 2$$

$$= n + 2$$

- (b) The n th term of a different sequence is given by $n^2 + 7$.

- (i) Write down the first three terms of this sequence. [2]

$$n = 1$$

$$1^2 + 7$$

$$= 1 + 7$$

$$= 8$$

$$1^{\text{st}} \text{ term} = 8$$

$$n = 2$$

$$2^2 + 7$$

$$= 4 + 7$$

$$= 11$$

$$2^{\text{nd}} \text{ term} = 11$$

$$n = 3$$

$$3^2 + 7$$

$$= 9 + 7$$

$$= 16$$

$$3^{\text{rd}} \text{ term} = 16$$

- (ii) Which term in this sequence is the first that has a value greater than 85? [2]

$$9^2 + 7$$

$$= 81 + 7$$

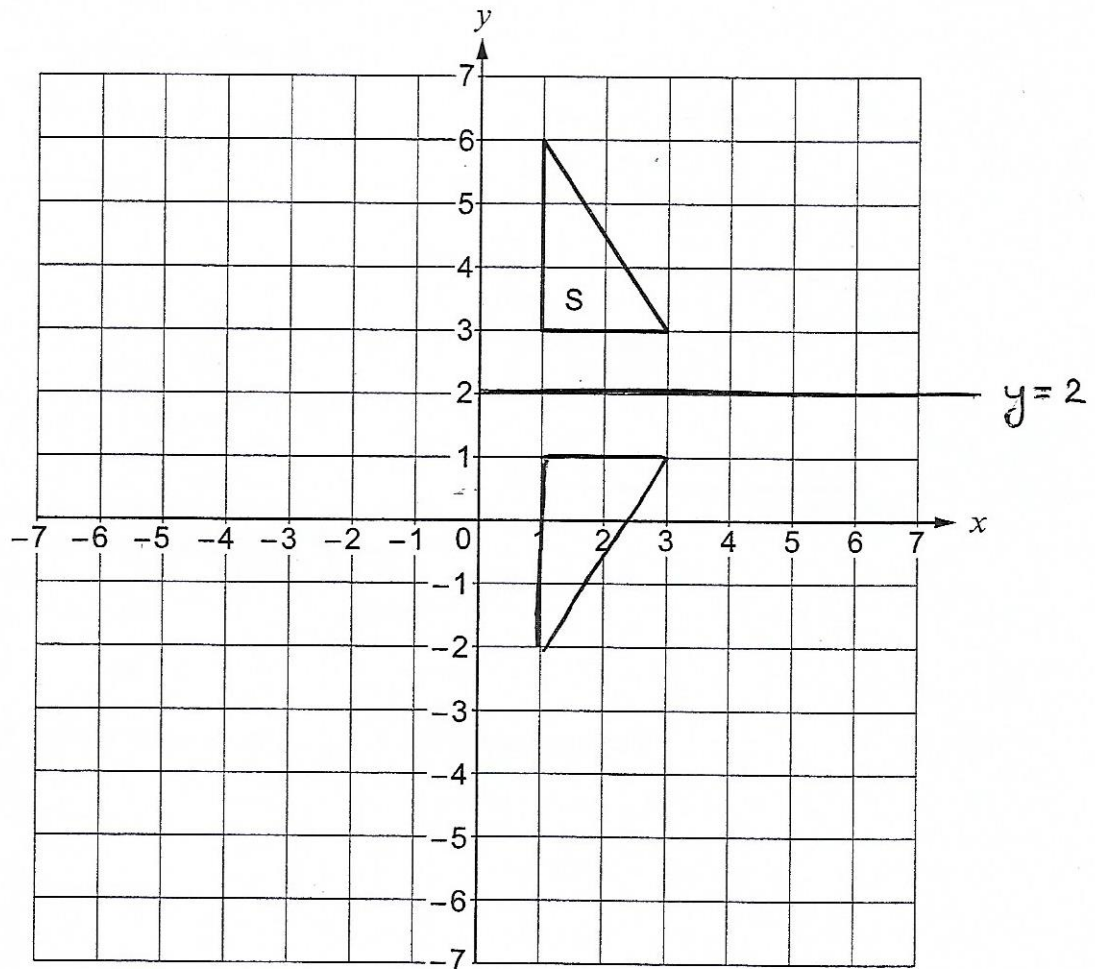
$$= 88$$

Answer = 9th term.

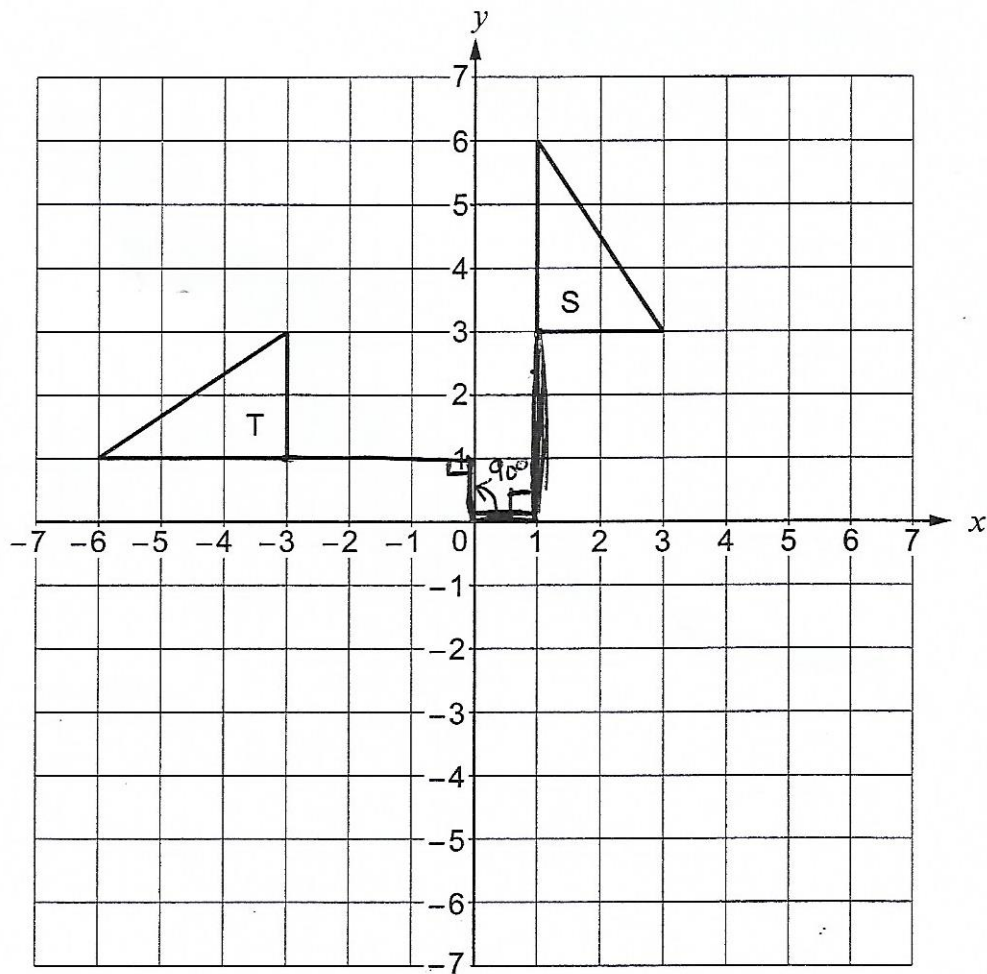


11. (a) Reflect the triangle S in the line $y = 2$.

[2]



(b) Describe fully a single transformation that transforms triangle S onto triangle T. [3]

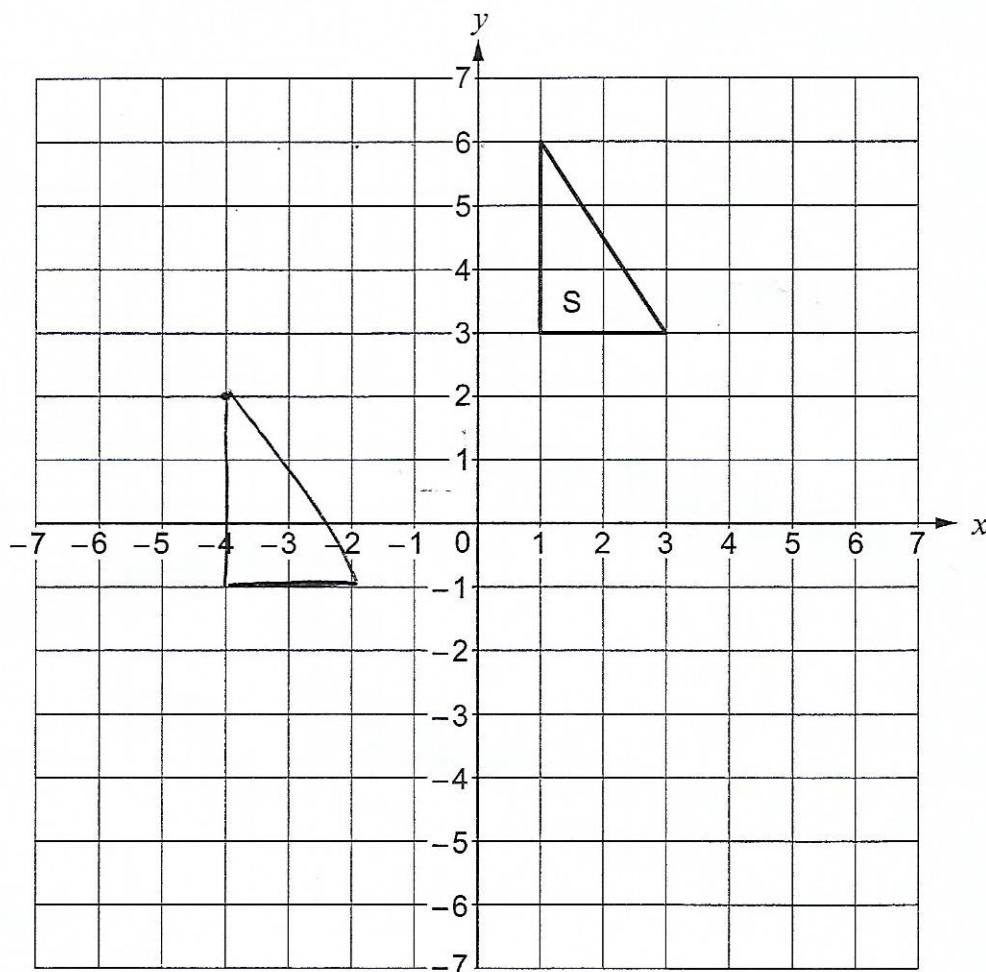


90° anti-clockwise rotation
about centre of rotation (0,0)



- (c) (i) Translate the triangle S using the column vector $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$. $\leftarrow$ 5 left
 $\leftarrow$ 4 down

[1]



- (ii) Write down the column vector that will reverse the translation in part (i).

[1]

$$\begin{array}{l} 5 \text{ right} \\ 4 \text{ up} \end{array} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$$



12. Circle the correct answer for each of the following.

(a) $x^3 \times x^6 =$

[1]

x^{36}

$x^{0.5}$

x^2

x^9

x^{18}

Add up the powers

(b) $(7x - 5y) - (3x + 2y) =$ $7x - 5y - 3x - 2y$

[1]

$4x - 3y$

$4x - 7y$

$4x + 3y$

$-4x + 7y$

$-4x - 7y$

(c) A car travels x miles in 30 minutes.
Its average speed in miles per hour is

[1]

$\frac{x}{2}$

$\frac{x}{30}$

$2x$

$\frac{2}{x}$

$30x$

x miles in 30 mins

 $\times 2$

$2x$ miles in 1 hour

$= 2x$ mph



13. A solution to the equation

$$2x^3 - 3x - 17 = 0$$

lies between 2 and 3.

Use the method of trial and improvement to find this solution correct to 1 decimal place.
You must show all your working.

[4]

Try $x = 2.5$

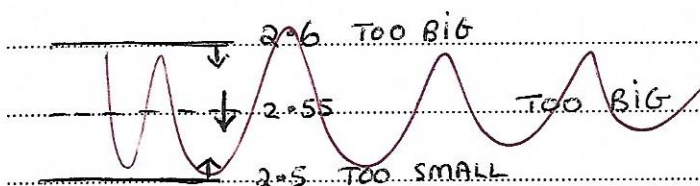
$$\text{LHS} = 2(2.5)^3 - 3(2.5) - 17 = +6.75 \quad \text{Too BIG}$$

Try $x = 2.8$

$$\text{LHS} = 2(2.8)^3 - 3(2.8) - 17 = +18.504 \quad \text{Too BIG}$$

Try $x = 2.6$

$$\text{LHS} = 2(2.6)^3 - 3(2.6) - 17 = +10.352 \quad \text{Too BIG}$$



Try $x = 2.55$

$$\text{LHS} = 2(2.55)^3 - 3(2.55) - 17 = +8.51275 \quad \text{Too BIG}$$

∴ $x = 2.5$ to 1 d.p.

$x = 2.3$

$$\text{LHS} = 2(2.3)^3 - 3(2.3) - 17 = +0.434 \quad \text{Too BIG}$$

$x = 2.2$

$$\text{LHS} = 2(2.2)^3 - 3(2.2) - 17 = -2.304 \quad \text{Too SMALL}$$

$$\underline{x = 2.25} \quad \text{LHS} = 2(2.25)^3 - 3(2.25) - 17 = -0.968 \quad \text{Too small}$$

∴ $x = 2.3$ to 1 d.p.



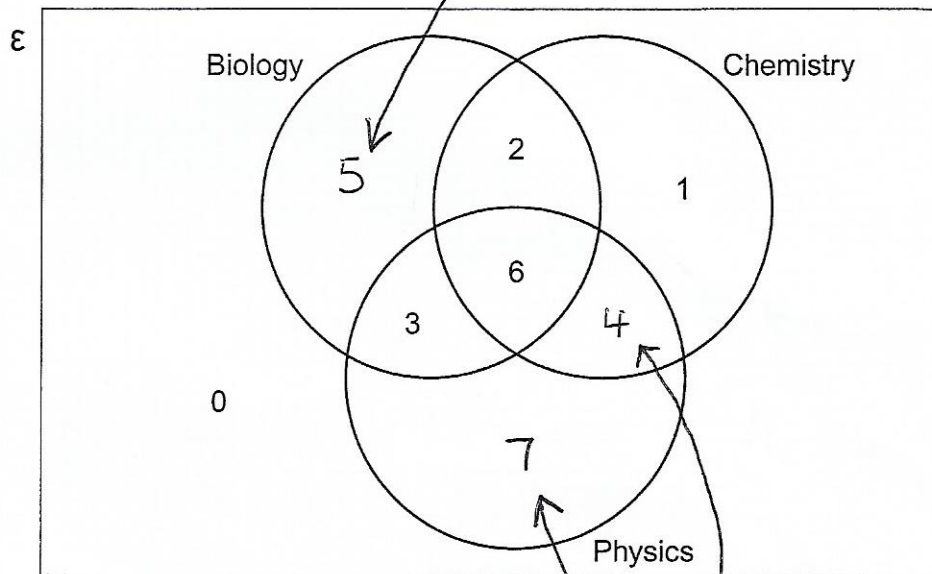
14. At a college, a total of 28 students study one or more of the science subjects: Biology, Chemistry and Physics.
The 28 students form the universal set, $\mathcal{E}$.
Some parts of the Venn diagram below have already been completed.

It is also known that:

- 5 students study only Biology
- 13 students study Chemistry

- (a) Complete the Venn diagram.

[3]



$$\text{Chemistry } 13 - 2 - 6 - 1 = 4$$

$$\text{TOTAL STUDENTS} = 28$$

$$\text{So } 28 - \text{all numbers} = 7$$

- (b) How many students study Biology and Chemistry but not Physics?

[1]

2

- (c) One of the students is chosen at random.
What is the probability that this student studies Biology?

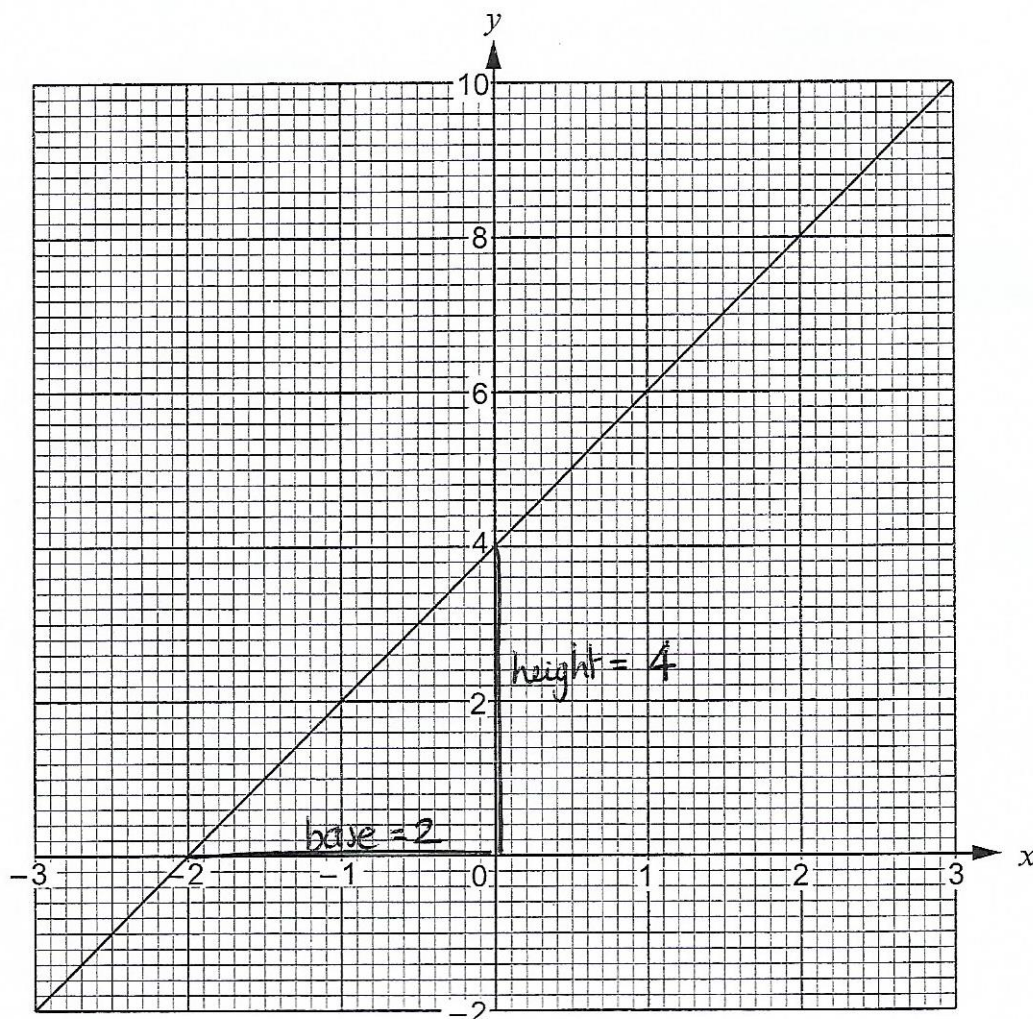
[2]

$$\text{Total Biology} = 5 + 2 + 6 + 3 = 16$$

$$\therefore P(\text{Biology}) = \frac{16}{28} = \frac{4}{7}$$



15. (a) The diagram below shows the graph of a straight line for values of x from -3 to 3 .



- (i) Write down the gradient of the above line. [1]

$$\text{gradient} = \frac{\text{height}}{\text{base}} = \frac{+4}{2} = +2$$

- (ii) Write down the equation of the line in the form $y = mx + c$, where m and c are whole numbers. [2]

$$y = 2x + 4$$

↑ ↑
gradient crosses y axis

- (b) Without drawing, show that the line $2y = 5x - 3$ is parallel to the line $4y = 10x + 7$. You must show working to support your answer. [2]

If they are parallel they have the same gradient

$$2y = 5x - 3$$

$$4y = 10x + 7$$

$$\div 2 \quad y = 2.5x - 1.5$$

$$\div 4 \quad y = 2.5x + 1.75$$

$$\text{gradient} = 2.5$$

$$\text{gradient} = 2.5$$

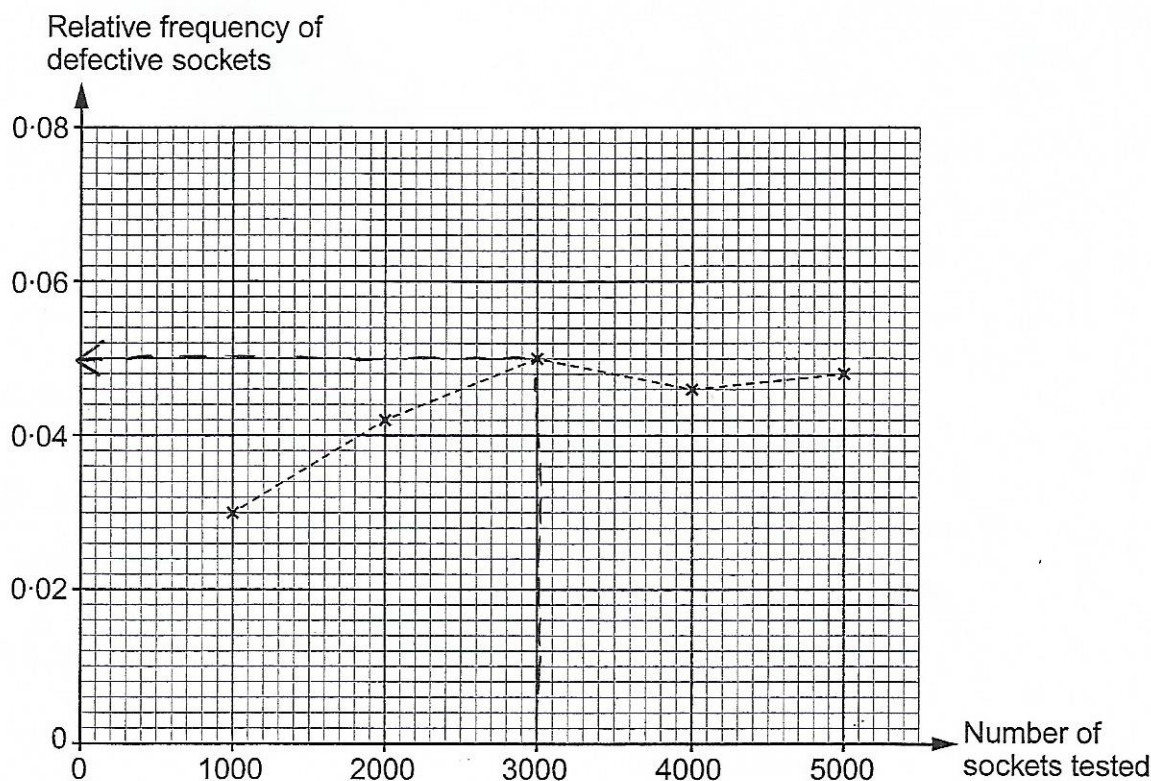
$\therefore$ Parallel



16. A factory uses a machine to produce electrical sockets. The manager carries out a survey to investigate the probability of the machine producing a defective socket.

The relative frequency of defective sockets produced was calculated after testing a total of 1000, 2000, 3000, 4000 and 5000 sockets.

The results are plotted on the graph below.



- (a) How many of the first 3000 sockets tested were defective? [2]

$$0.05 \times 3000 = 150$$

- (b) Write down the best estimate for the probability that one socket, selected at random, will be defective. You must give a reason for your choice. [2]

Probability: 0.048

Reason: This is the relative frequency of 5000 sockets.

The higher the no. of sockets tested is, the more likely that the relative frequency value is the probability value.



17. Points A , B , C and D lie on the circumference of a circle, centre O .
 BD is a diameter of the circle.
 The straight line $BC = 4.7$ cm and $\hat{BAC} = 28^\circ$.

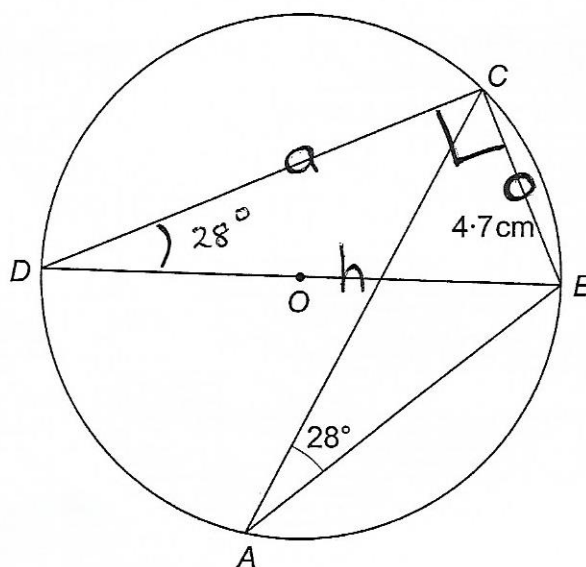


Diagram not drawn to scale

Write down the size of $\hat{BDC}$.
 Hence, calculate the length BD .
 You must show all your working.

[5]

$$\hat{BDC} = 28^\circ$$

Angles in same segment
 from chord BC are same.

$\triangle BCD$ is right-angled because BD is a diameter

Use ~~the~~ SOHCAHTOA

$$\sin x = \frac{o}{h}$$

$$\sin 28^\circ = \frac{4.7}{BD}$$

$$BD = \frac{4.7}{\sin 28^\circ}$$

$$BD = 10.01 \text{ cm}$$



18. (a) Factorise $x^2 - 2x - 24$, and hence solve $x^2 - 2x - 24 = 0$. [3]

$$= (x-6)(x+4)$$

$$\therefore (x-6)(x+4) = 0$$

either

$$x-6=0 \quad \text{or} \quad x+4=0$$

$$x=6 \quad \quad \quad x=-4$$

- (b) Solve the equation $\frac{4x-3}{2} + \frac{7x+1}{6} = \frac{29}{2}$. [4]

$$\text{LCM} = 6$$

$$\frac{3(4x-3)}{6} + \frac{(7x+1)}{6} = \frac{87}{6}$$

$$\times 6 \quad 3(4x-3) + (7x+1) = 87$$

$$12x - 9 + 7x + 1 = 87$$

$$19x - 8 = 87$$

$$19x = 87 + 8$$

$$19x = 95$$

$$x = \frac{95}{19}$$

$$x = 5$$

END OF PAPER

