GCSE – NEW

3300U40-1

wjec cbac

Annotated answers, hints & marking.

A16-3300U40-1

● Black – actual answers
● Red – Hints/facts to recall.
● Blue – How the marks are given
● Green – Identify the maths

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	

## Formula List – Intermediate Tier

Area of trapezium $= \frac{1}{2}(a+b)h$
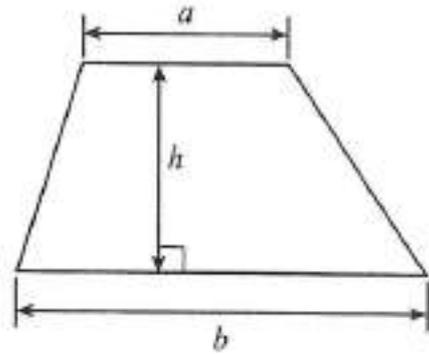
Volume of prism = area of cross-section × length
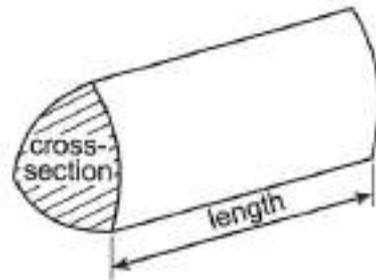
First couple of Q's are similar to BOOTCAMP and rarely change from year to year.

1. Using only the numbers in the following list, ← *check the answer is already here*

    57   58   59   60   61   62   63   64   65

    write down

    (a) a prime number, *(2,3,5,7,11,13,17,19 — only has 2 factors 1×n=n).*

    59 or 61 [1]

    (b) a cube number, *(n×n×n=n³ ie 1,8,27,64,125...)*

    64 [1] *Correct answers only*

    (c) a factor of 186, *(How to × to make 186* *1×186 2×93 etc... 3×62 6×31)*

    62 [1]

    (d) a multiple of 7·25. *(7·25 times tables 7·25, 14·50, 21·75 29 etc...)* [1]

    58 *36·25, 43·50, 50·75, 58*

    You can just keep + 7·25 on

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

    triangle = 180°

    (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° + 60 = 150°   180−150° = 30°

    Right angle   *4 sides = 360°*   *Correct answer only*   360

    (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] /180\

    360° − 250° = 110°

    Clockwise *anti Clockwise*   (360) etc.

    (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] └ 90°
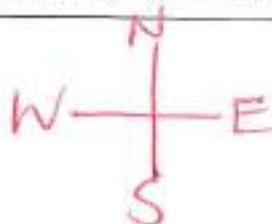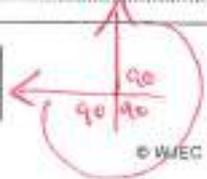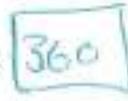
    N   90+90+90 = 270°

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

ie can turn & fit twice
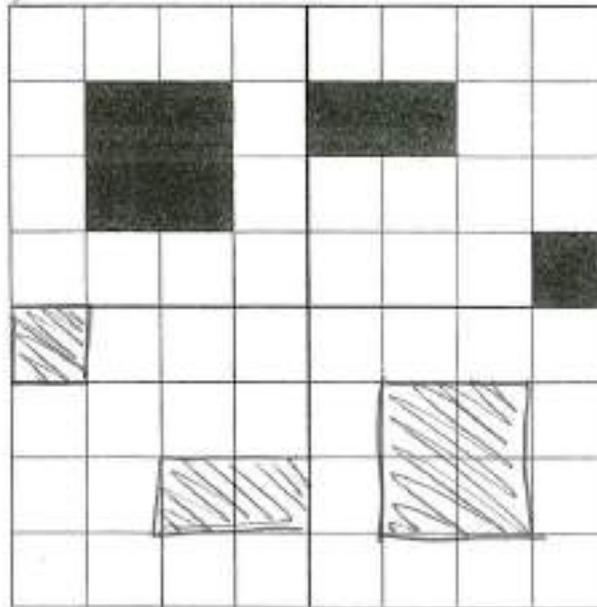
so opposite quads must be similar

lose 1 mark for each error

rotates = turns

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(3300U40-1)

Find the number [5]*value.*

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

reverse process

$$10 + 2 \div 3 = x$$
$$12 \div 3 = x$$
$$4 = x$$

1 method
1 for answer

(b) A number machine is shown below.

| INPUT | → | ADD 5 | → | MULTIPLY BY 7 | → | OUTPUT |
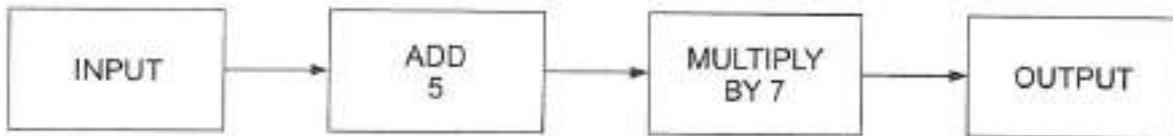
(i) Calculate the OUTPUT when the INPUT is –2. *Put value In &* [1]
Calculate in order

$$(-2 + 5) \times 7$$
$$3 \times 7 = 21$$

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

$$n + 5 \times 7$$
$$(n + 5) \times 7$$

Same as above but no number answer just ALGEBRA.

$$\text{or } 7(n + 5) = \text{output}$$

1 for putting letter "n" in & use of brackets.
*1 for Simplifying*

Examiner only

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 reverse	−2°C

1 mark each answer

Draw a No. line to help and use it

$$\xleftarrow{\quad} \overset{-7\ -6\ -5\ -4\ -3\ -2\ -1\ \ 0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5\ \ 6\ \ 7}{\;} \xrightarrow{\quad}$$
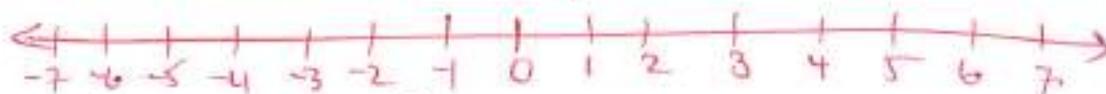
6.

Write on the diagram it is part of the method + workings.

74°
x 114°
360°
117°
180°
55 125°

ANGLE FACTS

360°
180°

Diagram not drawn to scale
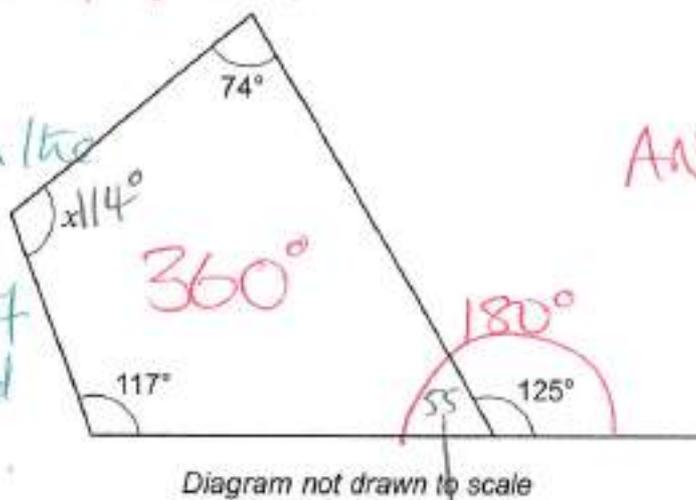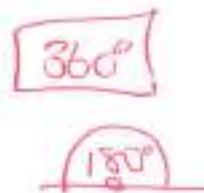
Find the size of angle x.

[3]

74
117
55+
246

380
246 −
114°

180
125 −
55°

$x =$ 114 °

2 method (2 steps needed) 1 answer.

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EXPLAIN by using calculation — *1 mark to test your own example*

2 marks for correct calcs.

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

1 mark for % false

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

Test with any number 100 is good for %

$$100+10$$

10% increase on 100 ⟶ 110

10% decrease on 110 ⟶ 110 - 11
$$= 99$$

not the same as before
so its False.

Work out the answers don't just guess.

1 mark lost for every error.

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

Same shape but side lengths can be different for each shape

STATEMENT	TRUE	FALSE
All <u>equilateral triangles</u> are congruent.	TRUE	(FALSE)
All <u>squares with equal areas</u> are congruent.	(TRUE)	FALSE
Circles with equal perimeters are congruent.	(TRUE)	FALSE
All <u>regular octagons</u> are congruent.	TRUE	(FALSE)
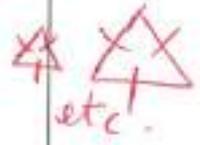
like equilateral Δ's can have different side lengths

Perimeter is circumference and means diameters are also equal

Congruent means exactly same size & same shape, angles, lengths

Squares have equal sides so to have same area sides must be the same as well.

Turn over.

Examiner only

Units, Explain, Label, Calculates + clear steps.

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.

Square ⊥ (equal) sides
Perimeter (+ all sides)

If circle fits its diameter is same as square side length

20cm

d
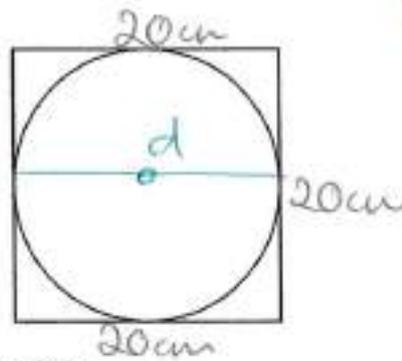
20cm

20cm

20cm

4 marks for calculations
2 for units & formula + clear steps

Calculate the circumference of the circle.
Give your answer correct to 1 decimal place.
You must show your working.

accuracy — could lose 1 mark

[4 + 2 OCW]

Square
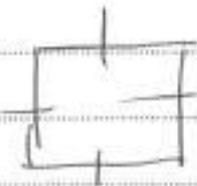
$$\square + \square + \square + \square = 80\text{cm}$$

side lengths = 20cm
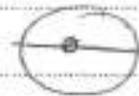
Circle → Diameter — must also be 20cm

$$\text{Circumference} = \pi \times d \quad\quad \pi = 3.14$$
$$C = 3.14 \times 20$$
$$C = 3.14 \times 2 \times 10$$
$$C = 6.28 \times 10$$
$$C = 62.8\text{ cm}$$

show formula

Cherry pie's delicious $C = \pi \times d$

Apple pie's are too $A = \pi \times r^2$

Learn the formula your not given this

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Sequences, rules n^{th} *term means the general rule*

10. **(a)** Write down the nth term of the following sequence. *← link term to position.* [2]

1st   2nd   3rd   4th
3, $+1$ 4, $+1$ 5, $+1$ 6,

Find the pattern

method
rule

n^{th} *term = Difference × n + a value*
           +1 × n + a value

$1 × n + 2$

(b) The nth term of a different sequence is given by $n^2 + 7$. *rule*

   (i) Write down the first three terms of this sequence. *Substitute values in for 'n'* [2] *Answers all correct*

$n = 1$ $1^2 + 7 = 8$

$n = 2$ $2^2 + 7 = 11$

$n = 3$ $3^2 + 7 = 16$

Subtituting n^2 1 mark

1st term = 8   2nd term = 11   3rd term = 16

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

As its an n^2 we use square No's

1, 4, 9, 16, 25, 36, 49, 64, 81, 100

Which when +7 is closest to 85

81

Patterns look at 1 mark

Answer 1 mark

9th

Answer = 9th term.

81 is 9^2 ~ $9 × 9$

So 9th term.

x = number are vertical ↕ *lines y = number are horizontal*

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

[2]

mirror image
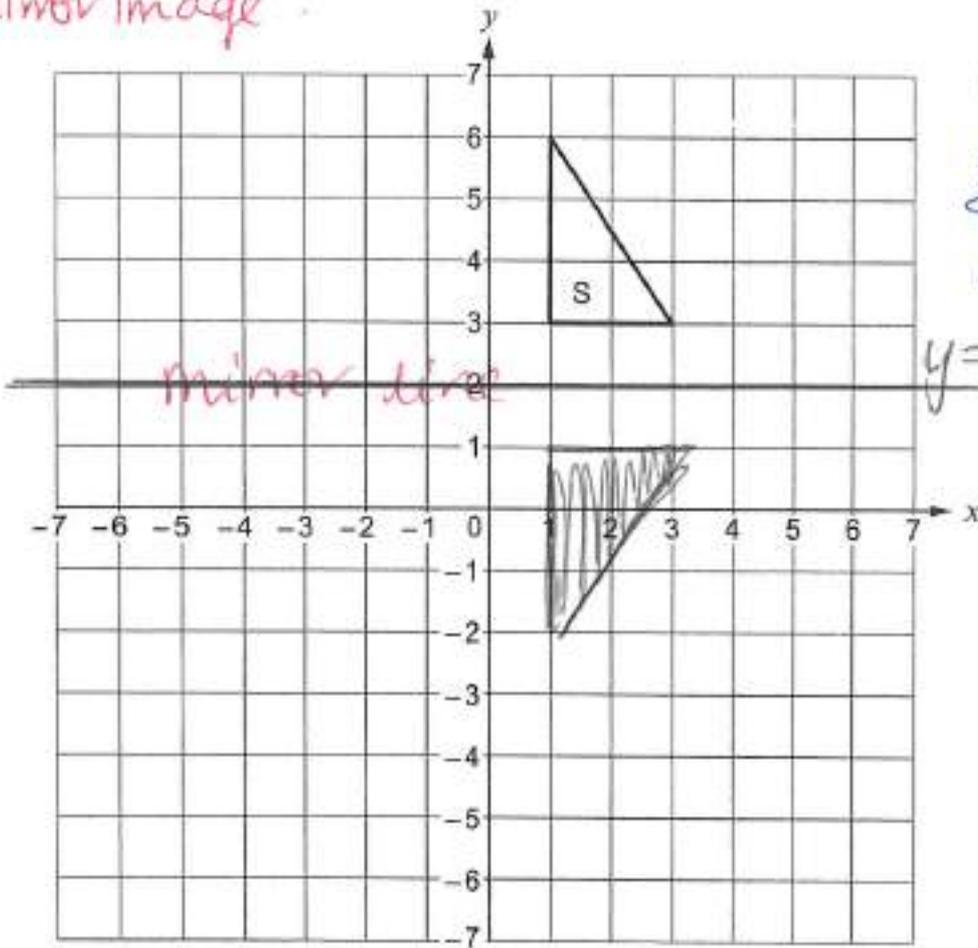
Size & position & minor line get the marks

mirror line   *y=2*

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ie reflection or rotation or enlargement or translation

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

[3]
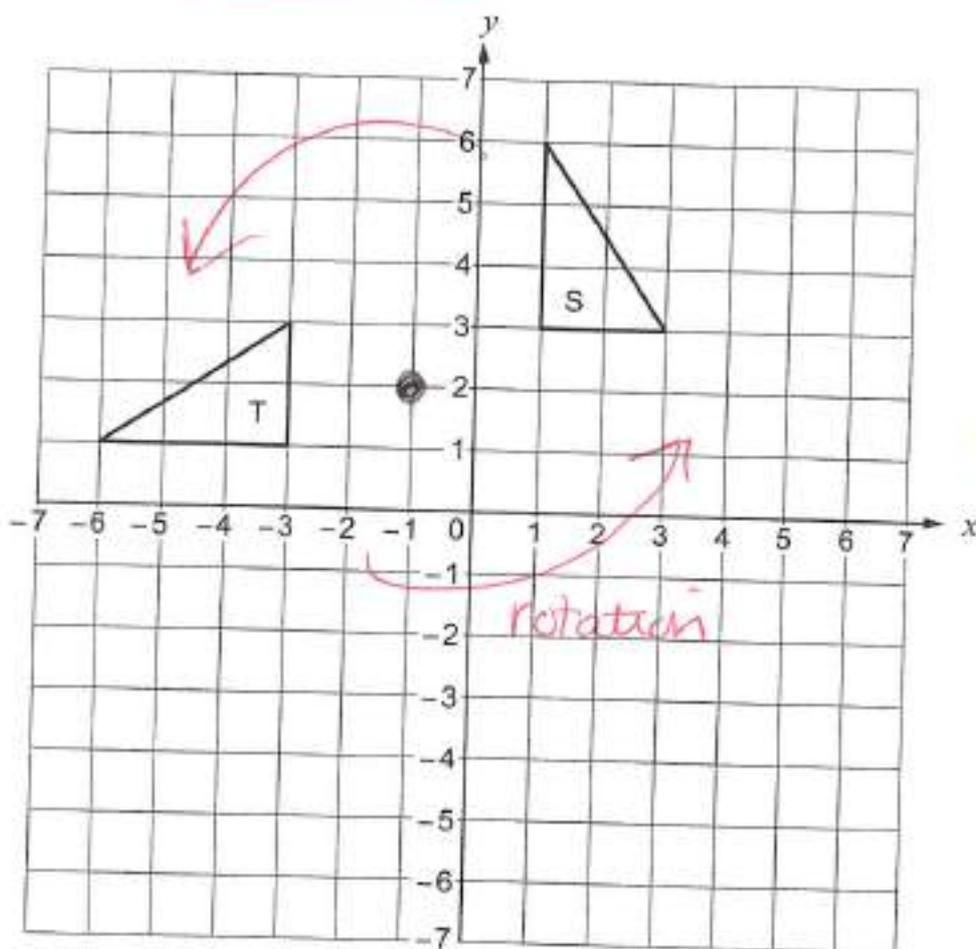
*3 points to make for each mark (detail).*

rotation

Rotation , anticlockwise , about the centre ① ① of rotation ① at (-1, 2)

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Turn over.

(c)   (i)   Translate the triangle S using the column vector $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$.   [1]

move in → x and y↑ directions

-5 ← ↓-4
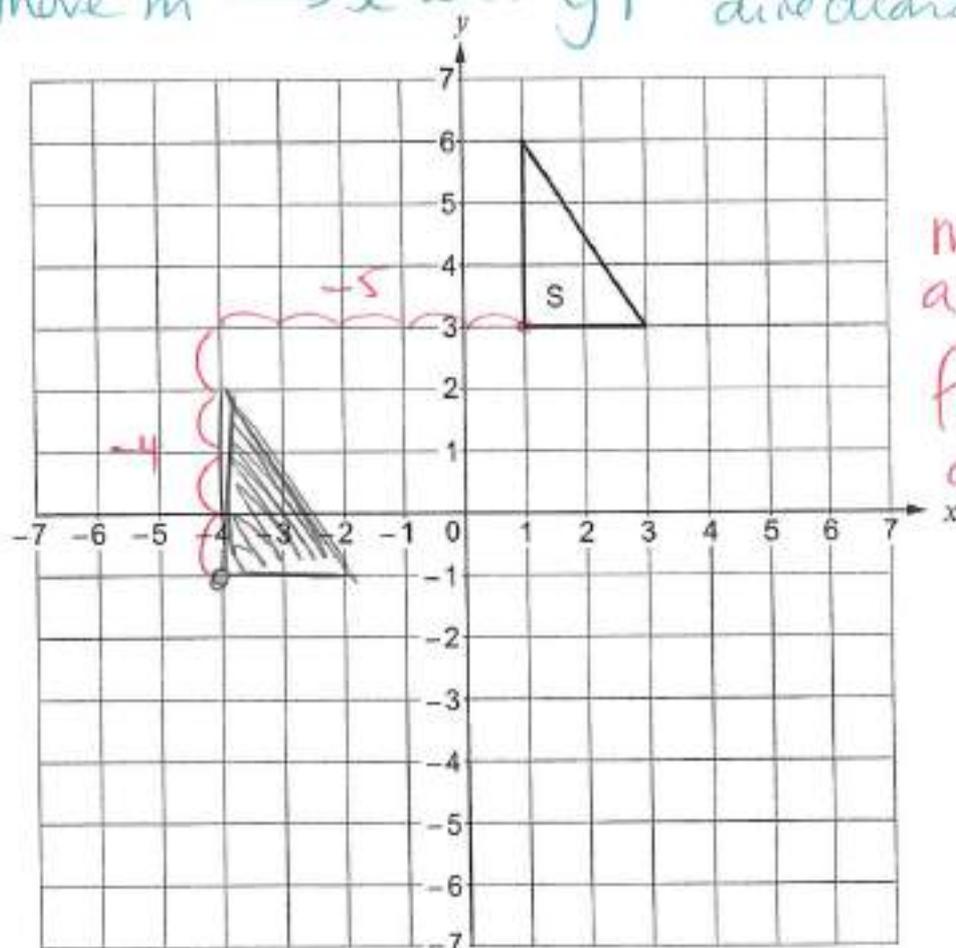
answer only

move a corner first, then another etc

(ii)   Write down the column vector that will reverse the translation in part (i).   [1]

opposite

$$\begin{pmatrix} 5 \\ 4 \end{pmatrix}$$

answer only

[Handwritten top note: Multiple Choice → work out all answers. Don't just guess]

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

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

[Handwritten: $x^n \times x^m = x^{n+m}$ rule]

[1]

x^{36} $x^{0.5}$ x^2 $\boxed{x^9}$ x^{18}

[Handwritten: $x^3 \times x^6 = x^{3+6} = x^9$]

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

[Handwritten: expand brackets (×) and simplify (collect like terms)]

[1]

$4x - 3y$ $\boxed{4x - 7y}$ $4x + 3y$ $-4x + 7y$ $-4x - 7y$

[Handwritten: $7x + 5y - 3x - 2y$]
[Handwritten: $7x - 3x - 5y - 2y$]
[Handwritten: $4x - 7y$]

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

[Handwritten triangle: D over S, T]

[1]

$\frac{x}{2}$ $\boxed{\frac{x}{30}}$ $2x$ $\frac{2}{x}$ $30x$

[Handwritten: Speed = $\frac{x}{30}$ in 1 hour time has doubled so distance doubles. $\frac{2x}{60}$]
[Handwritten: Speed = $\frac{Distance}{time}$]

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Examiner only

13. A solution to the equation

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

lies between 2 and 3. *—— start half way between values*

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

[4]

at least 2 steps shown, 1 mark for answer & Ans. 1 for further calcs

Try x =	$2x^3$	$-3x$	-17	Ans.
2.5	$2 \times 2.5 \times 2.5 \times 2.5$	-3×2.5	-17	
	31.25	-7.5	-17	6.75 *Ans. too big try again*
2.3	$2 \times 2.3 \times 2.3 \times 2.3$	-3×2.3 -6.9	-17	0.434 *still too big try again*
2.2	$2 \times 2.2 \times 2.2 \times 2.2$	-3×2.2 -6.6	-17	-2.304 ↑ *too small try again*
2.25	$2 \times 2.25 \times 2.25 \times 2.25$ 22.78125	-3×2.25 -6.75	-17	-0.96875 *too small*

answer is between 2.2 and 2.3

2.25 ———→ $x = 2.3$ to 1 d.p.

2.2 ——————————— 2.3

try half way to decide.

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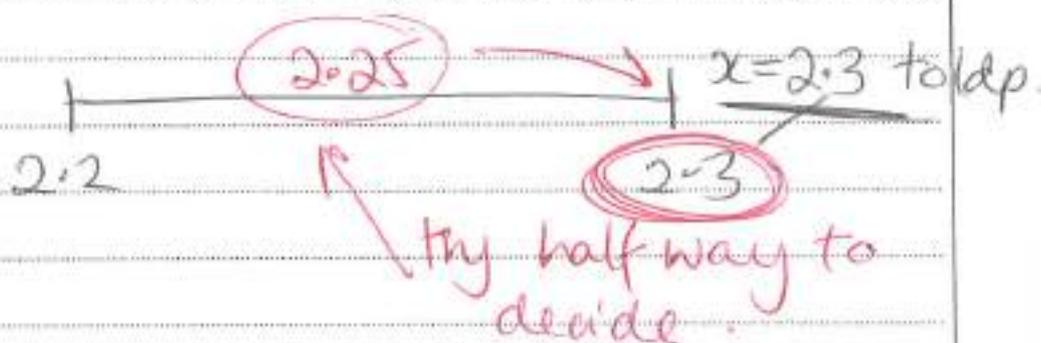
14. At a college, a total of 28 students study one or more of the science subjects: Biology, Chemistry and Physics.
The 28 students form the universal set, ε.
Some parts of the Venn diagram below have already been completed.

It is also known that:
- 5 students study only Biology
- 13 students study Chemistry

Write on diagram values from statements. [3]

(a) Complete the Venn diagram.

ε
28

Biology

5   2
        1
      6
3   4
0
      7

Chemistry
13   ——— 6+2+1+ 4 = 13

Physics

*3 answers
each ½ mark
each.*

Altogether its 28
$5+2+6+3+1+4+\square = 28$
$21 + \boxed{7} = 28$

Probability —— successes
—— outcomes 28

(b) How many students study Biology and Chemistry but not Physics? [1]
$5+2+1 = 8$ out of 28 $\dfrac{8}{28}$

answer only

(c) One of the students is chosen at random.
What is the probability that this student studies Biology? [2]
Biol $5+2+6+3 = 16$
$\dfrac{16}{28}$

Marks for top/bottom of fraction

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(handwritten annotations:) gradient ↑ intercept ↑

Examiner only

15. *(a)* The diagram below shows the graph of a straight line for values of x from −3 to 3.
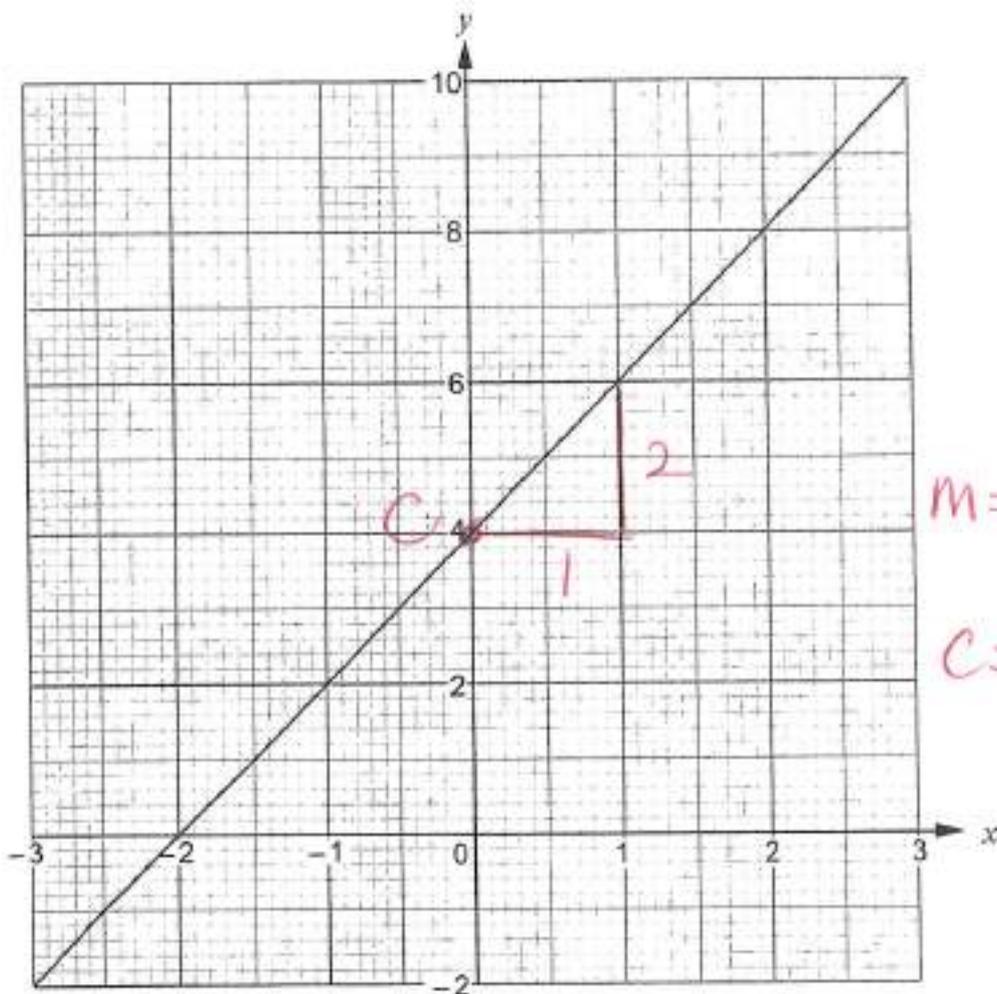
(handwritten on graph: C, 2, 1, $m = \frac{2}{1}$, $c = 4$)

(i) Write down the gradient of the above line.

[1]

$m = \frac{2}{1}$

(handwritten: answer only [1])

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

[2]

$y = \frac{2}{1}x + 4$ or $y = 2x + 4$

(handwritten: answer only and m and c values [2])

(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]

(handwritten working:)

Can only compare $y = \ldots$
so rearrange both eqtns

have the same gradient
$m_1 = m_2$

Calc +
$m_1 = m_2$

$2y = 5x - 3$

$y = \frac{5}{2}x - \frac{3}{2}$ $y = 2.5x - 1.5$

$4y = 10x + 7$
$y = \frac{10x}{4} + \frac{7}{4}$ $y = 2.5x + 1.75$

$m_1 = 2.5$

$m_2 = 2.5$

hence = so parallel.

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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.
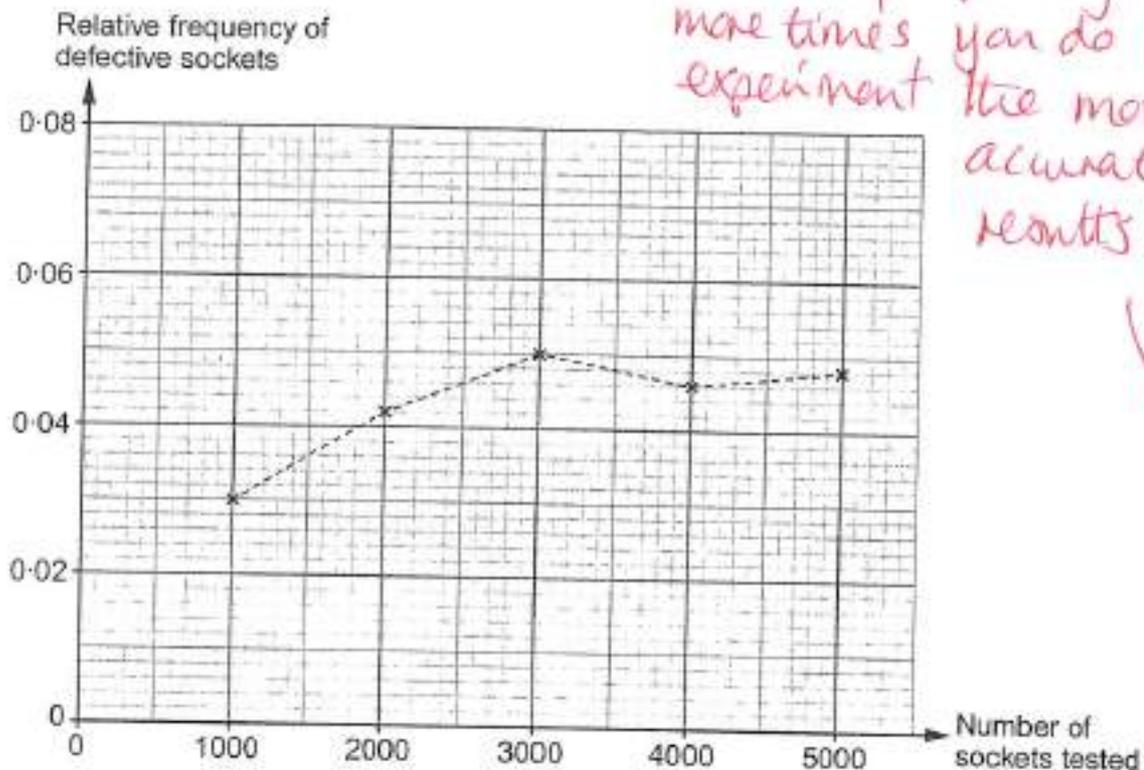
Relative frequency → the more times you do the experiment the more acurate the results

Relative frequency of defective sockets

Number of sockets tested

(a) How many of the first 3000 sockets tested were defective? *Read off graph* [2]

3000×0.05

$5 \times 3 = 15$

150 defects

$5 \times 3000 = 15000$

$0.5 \times 3000 = 1500$

$0.05 \times 3000 = 150$

Calculation + answer

(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. *best result is 5000 result.* [2]

Probability: $5000 \times 0.048 = \underline{240}$

Reason: More trials more acurate results so 5000 trial is best estimate.

1 answer 1 reason

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Turn over.

18

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 $B\hat{A}C$ = 28°.

Write on diagram it forms part the answer

C

96°

4·7 cm

D 28°

O

B

28°

A
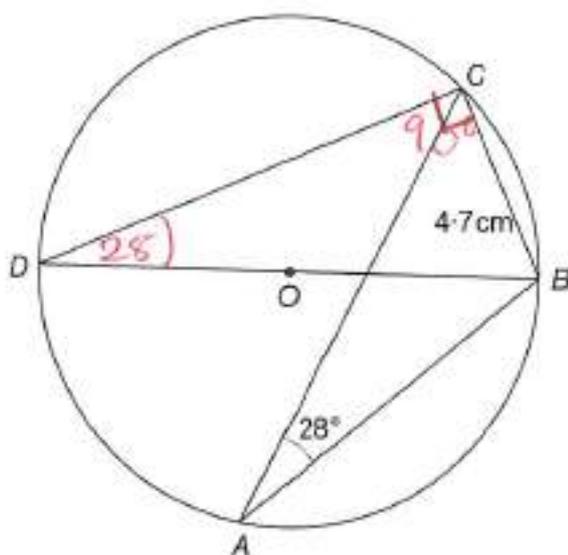
Diagram not drawn to scale
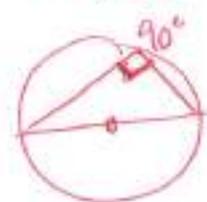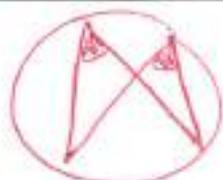
Learn them!

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

[5]

$B\hat{D}C = 28°$ ① (angles at circumference subtended by the same arc are equal). ①
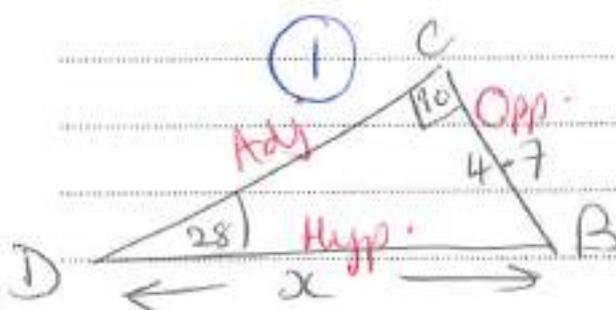
Use of circle theorem & correct use of trig.

① C

90°

Adj

4·7 Opp.

28 Hyp.

D ← x → B

∠Δ = trigonometry & angles

$Sin\theta = \frac{O}{H}$ $Cos\theta = \frac{A}{H}$ $Tan\theta = \frac{O}{A}$

①

$Sin\ 28 = \frac{4·7}{x}$

label Δ

$x = \frac{4·7}{Sin\ 28}$ $x = 10·01\ cm$ ①

Quadratic factorise is into double brackets ( )( )

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

[3]

$x \times x$ 1×24

2×12

3×8

$\boxed{4 \times 6}$ — difference of 2

2 marks for brackets 1 for answers

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

$x + 4 = 0$ $x - 6 = 0$

$x = -4$ $x = 6$

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

Fractions must have same value on bottom

[4]

$\times 3$ $\times 1$ $\times 3$

$\dfrac{12x - 9}{6} + \dfrac{7x+1}{6} = \dfrac{87}{6}$

X to get the same

1 for common denominator 2 for simplifying 1 for answer

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

$19x - 8 = 87$

$19x = 87 + 8$

$19x = 95$

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

$x = 5$

END OF PAPER