DULWICH COLLEGE
FOUNDED 1619

Year 9 Entrance and Scholarship Examination Mathematics

MARK SCHEME

Specimen Paper C

TIME allowed for this paper: 90 minutes

Instructions

- Use a calculator where appropriate.
- Answer all the questions.
- Show all your working.
- Marks for questions are shown in square brackets [ ].
- There are 140 marks in total
- You must not write in the squares at the bottom right of each page

1. Use your calculator to work out the value of:

$$\frac{\sqrt{436-13^2}}{76-35}$$

(a) Write down all of the digits shown on your calculator:

Answer: 0.3985398692 [1] B1

(b) Write your answer to (a) rounded to 3 decimal places:

Answer: 0.399 [1] B1ft

(c) Write your answer to (a) rounded to 2 significant figures:

Answer: 0.40 [1] B1ft

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2. Mike's Gym had 650 male members and 350 female members in 2008.

(a) Calculate the percentage of the members of Mike's Gym in 2008 who were male.

$\frac{650}{650+350} \times 100$ M1

Answer: 65 % [2] A1

(b) Given that the number of female members decreased by 10% from 2008 to 2009, calculate the number of female members in 2009.

0.9×350 or 0.1×350 or 35 M1

Answer: 315 [2] A1

(c) If there were 910 male members of the sports club in 2009, calculate the percentage increase of male members between 2008 and 2009.

$\frac{910-650}{650} \times 100$ M1

Answer: 40 % [2] A1

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3. (a) Simplify the ratio 20 : 15.

$\frac{20}{5} : \frac{15}{5}$ M1 Answer: 4 : 3 [2] A1

(b) Divide £280 in the ratio 20 : 15.

~~35~~ 7 parts → £280 or 7 parts → £280

1 part → ~~£8~~ 1 part → £40 M1

A1 A1

Answer: £ 160 , £ 120 [3]

(c) A recipe for a large cake uses 400 grams of flour and 300 grams of butter. A recipe for a smaller cake uses 300 grams of flour. Calculate how much butter is needed for the smaller cake if the ratio of flour to butter is to be the same in both cakes.

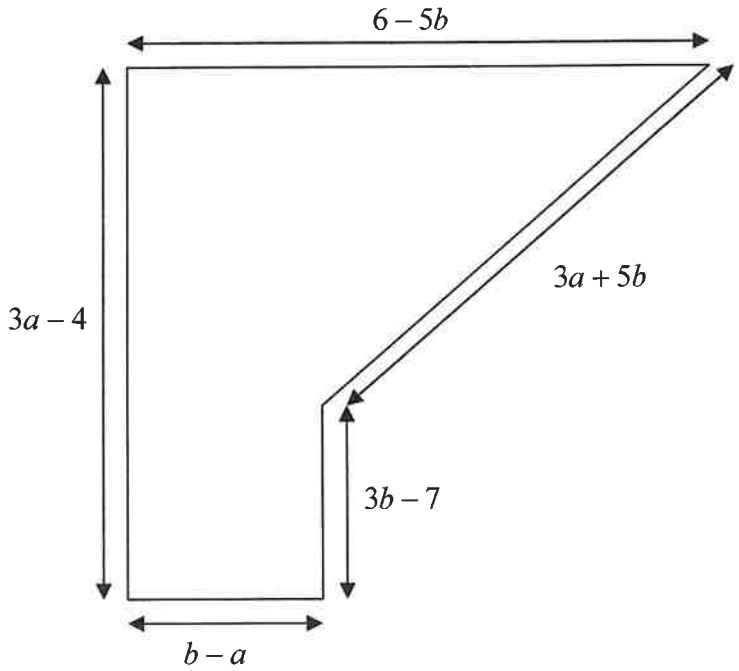
$\frac{3}{4} \times 400 : 300 \times \frac{3}{4}$ M1

300 : 225 M1

Answer: 225 grams [3] A1

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4. Write a simplified expression for the perimeter of the shape drawn below.



B1 B1 B1

Answer: $-5 + 5a + 4b$ [3]

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5. Write the following list of numbers in ascending order (i.e. smallest first):

$\frac{3}{16}$, 0.18, $\frac{1}{5}$, 18.5%

$\frac{3}{16} = 0.1875$

$\frac{1}{5} = 0.2$

$18.5\% = 0.185$

M1 for any adjacent two in correct order

Answer: 0.18, 18.5%, $\frac{3}{16}$, $\frac{1}{5}$ [2] A1 all correct

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6. Expand the brackets and simplify where possible:

(a) $5(3a+4)-4(4a-2)$

$= 15a + 20 - 16a + 8$ (M1, M1)

Answer: $-a + 28$ [3] A1

(b) $(b-2)(b+7)$

$= b^2 - 2b + 7b - 14$

B1 B1 B1

Answer: $b^2 + 5b - 14$ [3]

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7. (a) Simplify $\frac{50a^3b^2}{15ab^3}$ $= \frac{10a^3b^2}{3ab^3} = \frac{10a^2b^2}{3b^3}$

B1 B1

Answer: [3]

(b) Factorise fully:

(i) $18x - 60$

B1 B1

Answer: $6(3x - 10)$ [2]

S.C. $3(6x-20)$ scores M1A0

(ii) $5a^2b - 20a^3b^2$

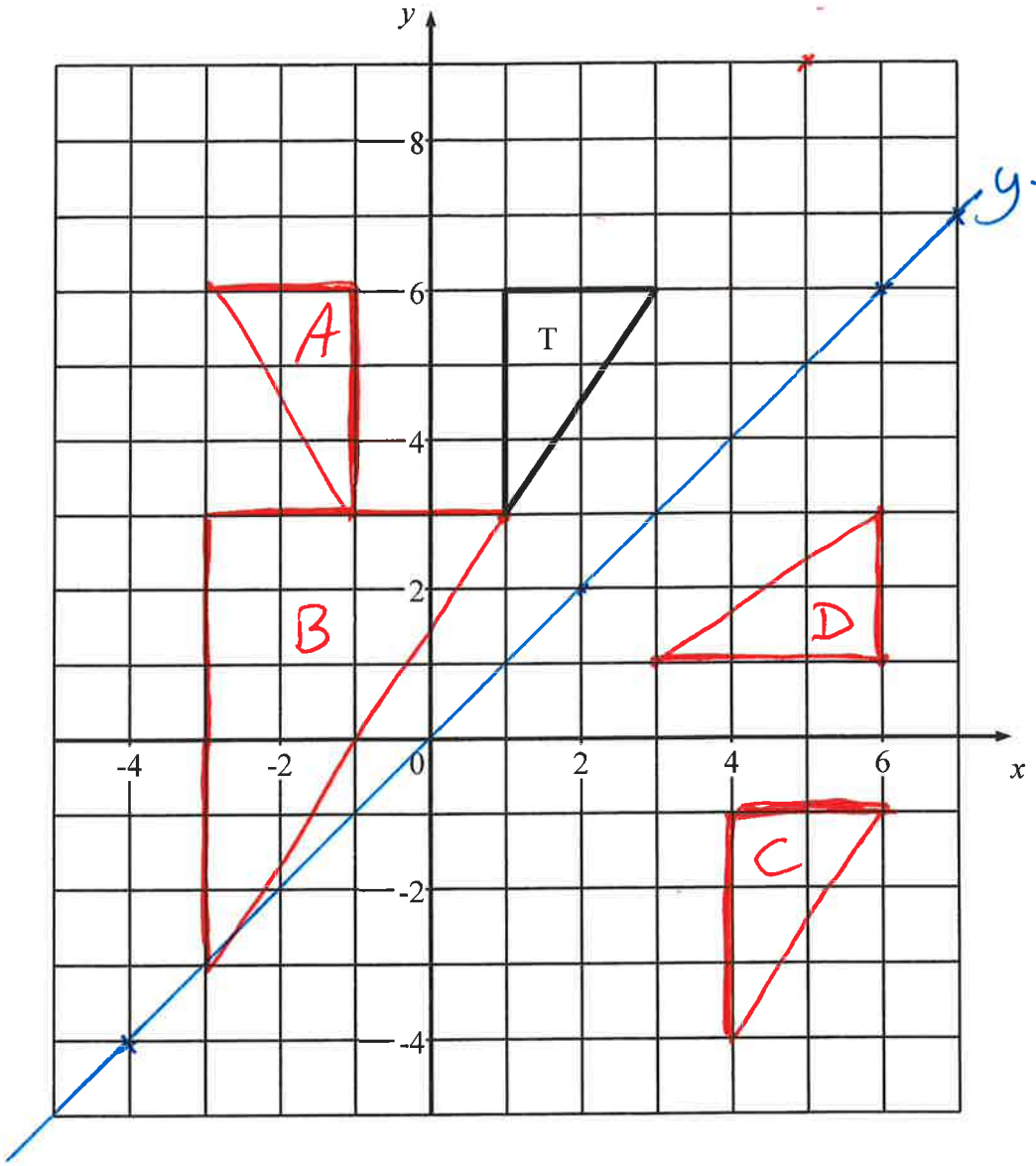
B1 B1

Answer: $5a^2b(1 - 4ab)$ [2]

S.C. any correct partial factorisation scores M1A0

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8.



On the grid above draw the result of:

(a) reflecting triangle T in the y-axis. Label your answer A. [2]

B1 location
B1 orientation

(b) enlarging **triangle T** by a scale factor of 2 with centre of enlargement (5, 9). Label your answer B. [2]

B1 location
B1 size/orientation

(c) translating **triangle T** by the vector $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$. Label your answer C. [2]

B1 'x' 3 units right
B1 'y' 7 units down

(d) reflecting **triangle T** in the line $y = x$. Label your answer D. [2]

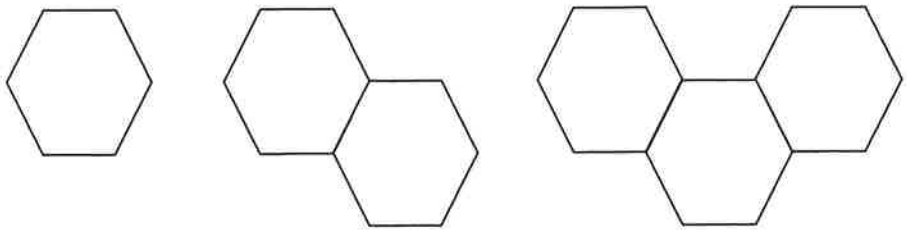
B1 drawing $y=x$

B1 triangle D.

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9. The following diagrams show a shape formed by adding successive regular hexagons to an initial hexagon.

Diagram 1 Diagram 2 Diagram 3



(a) Complete the following table showing the number of straight lines (L) for each diagram (D).

Diagram (D)	Number of straight lines (L)
1	6
2	11
3	16
4	21

B1

[1]

(b) Write down a formula for L in terms of D.

B1 B1

L = 5D + 1 [2]

(c) Calculate:

(i) L when D = 100.

L = 5 × 100 + 1
or their (b)
M1

L = 501 [2] A1

(ii) D when L = 251.

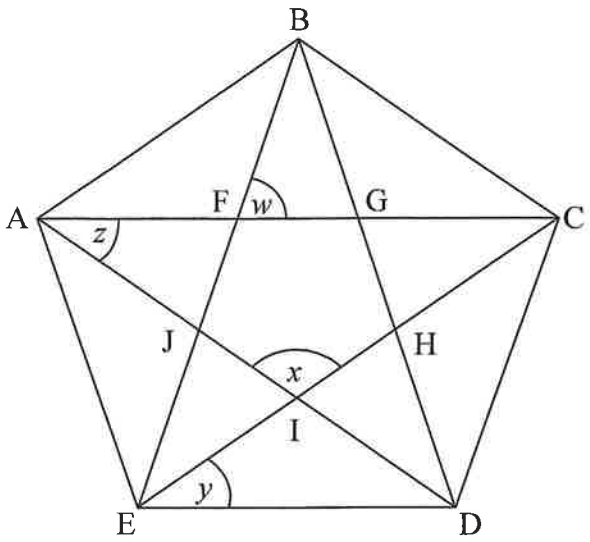
D = L − 1 / 5 M1

D = 251 − 1 / 5

D = 50 [2] A1

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10. The diagram below shows a regular pentagon ABCDE. Within this regular pentagon a regular pentagram (a 5-pointed star) has been drawn, which in turn contains another regular pentagon FGHIJ.



Calculate the size of the angle marked:

(a) w, $\frac{360}{5}$ M1

$w =$ 72 ° [2] A1

(b) x, 180 − "72" M1

↑ allow their w

$x =$ 108 ° [2] A1ft

(c) y, $\frac{180 - \text{"}108\text{"}}{2}$ M1

↖ allow their x

$y =$ 36 ° [2] A1ft

(d) z. 180 − "72" − "72" M1

↑ allow their x ↗

S.C. z = their y score M1A1ft

$z =$ 36 ° [2] A1ft

11. Solve the following equations:

(a) $\frac{10x}{7} = 3$

$10x = 21$ M1

$x = \frac{21}{10}$ [2] A1

(b) $3 - 5x = 8$

$3 = 8 + 5x$
$-5 = 5x$ M1 for a sensible attempt

$\frac{-5}{5} = x$

$x = -1$ [2] A1

(c) $4x + 5 = 2x + 3$

$2x + 5 = 3$
$2x = -2$ M1 for a sensible attempt

$x = \frac{-2}{2}$ M1

$x = -1$ [3] A1

(d) $x(2x - 3) = 2x^2 - 5(x + 2)$

$2x^2 - 3x = 2x^2 - 5x - 10$ B1

$-3x = -5x - 10$
$2x = -10$ M1 for a sensible attempt
$x = \frac{-10}{2}$

$x = -5$ [3] A1

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12. Calculate the value of a half of a third of 0.9.

$\frac{1}{2} \times \frac{1}{3} \times 0.9$ M1

Answer: 0.15 [2] A1

13.(a) Two unbiased dice are rolled and their values added together. Complete the table below to show the possible sum of the scores of the two dice.

Die 1

Die 2	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

B2 - all correct

B1 - no more than 3 mistake

[2]

(b) Use the table to calculate the probability of rolling a sum less than 8 when rolling two fair dice.

"21" / 36] M1 for ÷36

58 1/3 %

Answer: $\frac{21}{36}$ or $\frac{7}{12}$ [2] A1

(c) If the two numbers shown on the dice are **multiplied** rather than added, find the probability that the result is a prime number.

2×1 → $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

1×2 → 1/36

3×1 → 1/36

1×3 → 1/36

5×1 → 1/36

1×5 → 1/36

] M1

or M1

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3			etc			
4						
5						
6						

Answer: $\frac{6}{36}$ or $\frac{1}{6}$ [2] A1

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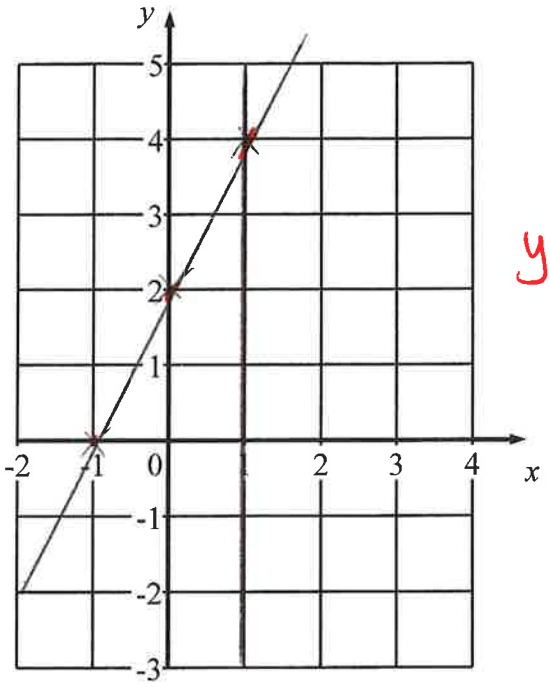
14. (a) Complete the following table of values for $y = 2x + 2$

x	-1	0	1
y	0	2	4

B2 all right
B1 two correct

[2]

(b) Plot and label the lines $y = 2x + 2$ and $x = 1$ on the axes below.



$x = 1$ is B1

$y = 2x + 2$ is { B1 plotting "their" values correctly
B1 correct final line

[3]

(c) Write down the co-ordinates of where the lines $y = 2x + 2$ and $x = 1$ intersect.

B1 B1

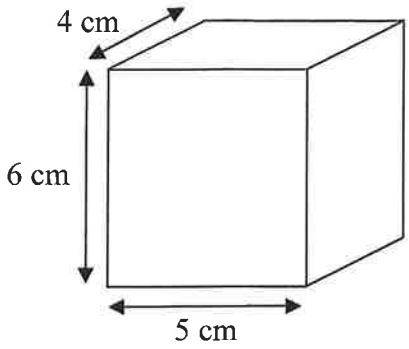
Answer: (1, 4) [2]

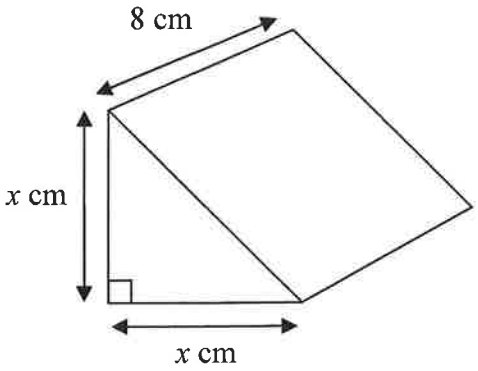
(d) Calculate the area of the triangle formed by the lines $y = 2x + 2$, $x = 1$ and the x-axis.

$\frac{1}{2} \times 2 \times 4$ M1 for attempting to use "$\frac{1}{2} \times b \times h$"

Answer: 4 [2] A1

15. The diagrams below show a cuboid and a right-angled triangular prism with dimensions as indicated.





(a) Calculate the volume of the cuboid.

$4 \times 6 \times 5$ m1

Answer: 120 cm^3 [2] A1

(b) Calculate the volume of the triangular prism, leaving your answer simplified in terms of x.

$\left(\frac{1}{2} \times x \times x\right) \times 8$ m1 m1

Answer: $4x^2$ cm^3 [3] A1

(c) The volume of the triangular prism is equal to the volume of the cube. Calculate the value of x, writing your answer to 3 significant figures.

$4x^2 =$ "120" m1 allow their (a)

$x^2 = 30$

$x = \sqrt{30}$ m1

$x =$ 5.48 [3] A1 ft

16. (a) My running speed is twice my walking speed. I can walk 120 metres in 80 seconds. Calculate how long it takes me to run 60 metres.



W: $S_W = \frac{D_W}{T_W} = \frac{120}{80} = 1.5$ m1

R: $T_R = \frac{D_R}{S_R} = \frac{60}{3}$ m1

Answer: 20 seconds [3] A1

(b) Peter's running speed is three times his walking speed. Peter can walk $2p$ metres in p seconds. Calculate how long it takes Peter to run 60 metres.

W: $S_W = \frac{D_W}{T_W} = \frac{2p}{p} = 2$ m1

R: $T_R = \frac{D_R}{S_R} = \frac{60}{6}$ m1

Answer: 10 seconds [3] A1

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17. Sarah's age is one third that of her father. The difference between their ages is 30 years. Calculate the age of Sarah's father.

Let x be Sarah's father age

$x - \frac{x}{3} = 30$ m1

$\frac{2x}{3} = 30$

$2x = 90$

$x = \frac{90}{2}$

m1 for a sensible method to solve their equation.

Answer: 45 [3] A1

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18. (a) A group of 10 students were asked to name what they thought was their favourite prime number. The answers they gave were:

1, 3, 11, 11, 17, 19, 21, 23, 23, 23

(i) Write down how many students answered the question with a number which was **not** prime.

Answer: 2 [1] B1

(ii) Calculate the mode and mean for the 10 answers.

mean = $\frac{1+3+11+11+17+19+21+23+23+23}{10}$] m1 = $\frac{"152"}{10}$

Mode = 23 A1 Mean = 15.2 A1 [3]

(b) An 11th student is now asked for his favourite prime number. The mean of all 11 answers is 25.

(i) Calculate the number which the 11th student gave.

Let x be number 11th student gave

$\frac{"152" + x}{11} = 25$] m1

$152 + x = 275$] m1 for sensible attempt

allow their previous answer

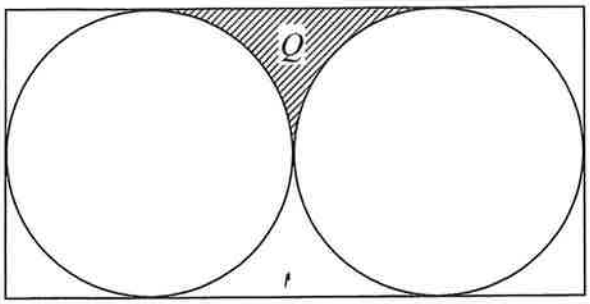
Answer: 123 [3]

(ii) State yes or no, with a reason, whether the number which the 11th student gave was a prime number.

Answer (Y/N): N B1, Reason: divisible by 3 B1 [2]

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19. The diagram below shows a rectangle containing two circles with the same radius. Each circle has an area of 25π cm^2.



(a) Calculate the radius of the circles.

$\pi r^2 = 25\pi$

$r^2 = 25$

$r = \sqrt{25}$

M1 for sensible attempt

Answer: 5 cm [2] A1

(b) Calculate the perimeter of shaded area labelled Q in the diagram.
Round your answer to 3 significant figures.

Attempt to use '$2\pi r$'

M1 $\frac{2 \times \pi \times "5"}{4}$ allow their r $= 7.853...$

$+$

$+ \frac{2 \times \pi \times "5"}{4}$ $= 7.853...$

$+$

M1 $+ 2 \times "5"$ $= 10$

Answer: 25.7 cm [3] A1

20. The following three numbers are prime: 5, 13, 17.

(a) The remainder is the same when each of these prime numbers is divided by 4. Calculate this remainder.

Remainder = 1 [1] B1

(b) Calculate a, b, c, d and e given that

$$5 = 1^2 + a^2$$
$$13 = 2^2 + b^2$$
$$17 = c^2 + 1^2$$
$$29 = d^2 + e^2$$

B1 for at least 2 correct B1

$a =$ 2 $b =$ 3 $c =$ 4 $d =$ 2 or 5 $e =$ 5 or 2 [3] B1 all correct

(c) Calculate the next prime number after 29 which is the sum of two square numbers.

$6^2 + 1^2$ M1

Answer = 37 [2] A1

(d) In a similar way, solve $61 = x^2 + (x-1)^2$.

$61 = 6^2 + 5^2$ M1

$x =$ 6 [2] A1

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21. A new way to combine two numbers, written $a \otimes b$, is calculated by multiplying the two numbers together and then subtracting both numbers.

For example, $3 \otimes 5 = 3 \times 5 - 3 - 5 = 7$.

(a) Calculate $2 \otimes 6$

$= 2 \times 6 - 2 - 6$ M1

Answer = 4 [2] A1

(b) Calculate $4 \otimes -2$

$4 \times (-2) - 4 + 2$ M1

$= -8 - 4 + 2$

Answer = -10 [2] A1

(c) Solve $x \otimes 3 = 11$

$3x - x - 3 = 11$ M1

$2x - 3 = 11$

$2x = 14$

$x =$ 7 [2] A1

(d) Solve $x \otimes (x + 1) - 8 = x \otimes x$

$x^2 + x - x - x - 1 - 8 = x^2 - x - x$

M1 for either LHS or RHS

$x^2 - x - 9 = x^2 - 2x$

$-x - 9 = -2x$

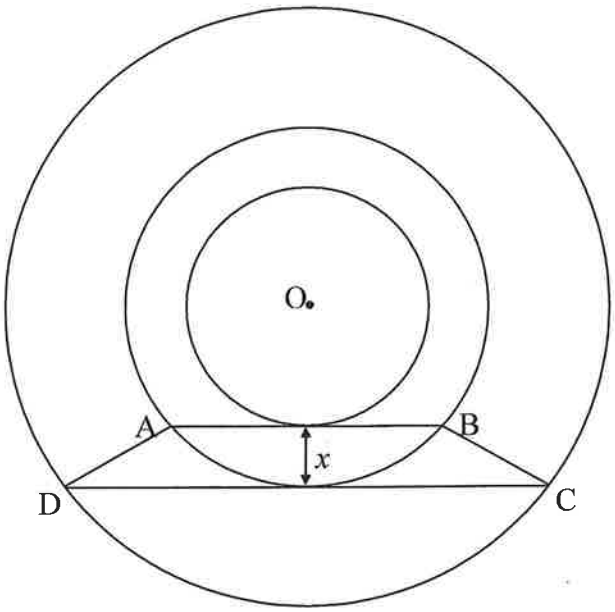
$x - 9 = 0$

M1 for a sensible attempt to solve their equation which must involve an "x^2"

$x =$ 9 [3]

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22. The diagram below (**not drawn to scale**) shows three circles all centred on O. The radius of the smallest circle is 6 cm and the radius of the middle circle is 10 cm. The trapezium ABCD has been drawn as shown so that AB just touches the smaller circle and DC just touches the middle circle.



(a) Calculate the minimum distance between the smallest and middle circle, marked x in the diagram.

Answer: 4 cm [1] B1

(b) Calculate the length AB.



$2 \times \sqrt{10^2 - 6^2} = 2 \times 8$

M1 or a correct attempt using Pythag Thm.

Answer: 16 cm [2] A1

(c) Given that the area of the trapezium is 128 cm^2, calculate the length DC.

$\frac{1}{2}(\text{"16"} + DC)4 = 128$

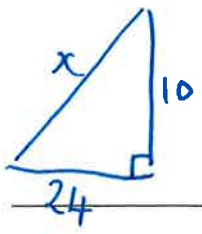
M1 with their (b) and (a)

$64 + 4DC = 256$

$4DC = 192$

Answer: 48 cm [2] A1

(d) Calculate the radius of the larger circle.



$x^2 = \text{"24"}^2 + 10^2$ M1 using their "$\frac{DC}{2}$"

$x = \sqrt{676}$

Answer: 26 cm [2] A1

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END OF THE PAPER.
IF YOU HAVE TIME THEN GO BACK AND CHECK YOUR ANSWERS