DULWICH COLLEGE
FOUNDED 1619

Year 9 Entrance and Scholarship Examination Mathematics

MARK SCHEME

Specimen Paper A

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 100 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:

$$\frac{3^2+4^3}{4+\sqrt{5}}$$

(a) writing down all the digits of your answer from your calculator,

Answer: 11.706094 33 [1] B1

(b) correct to 2 decimal places,

Answer: 11.71 [1] B1ft

(c) correct to 5 significant figures.

Answer: 11.706 [1] B1ft

(ft only if "their" answer contained a zero which is significant)

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2. Below is a sequence of numbers:

15, 8, 1, −6, ...

Calculate:

(a) the 7th term of this sequence,

-13, -20, -27

Answer: −27 [1] B1

(b) the 100th term of this sequence.

nth term = −7n + 22

= −7×100 + 22

M1 for either line

Answer: −678 [2] A1

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3. A shop is currently selling a games console for £245.

The shop buys the console from the manufacturers for £175.

(a) Calculate the percentage profit that the shop makes.

$\frac{245 - 175}{175} \times 100$

M1

Answer: 40 % [2] A1

The shop needs to add on VAT (Value Added Tax) at 20% to the current selling price.

(b) Calculate the new selling price of the games console, i.e. including VAT.

245×1.20 M1

Answer: £ 294 [2] A1

The shop also sells games for this games console. Each game has a selling price, including VAT, of £18. A student is entitled to a student discount of 7% off any games purchased.

(c) Calculate how much the student will pay for 5 games.

$5 \times 0.93 \times 18$

M1

Answer: £ 83.70 [2] A1

Page total: 6

4. Calculate the value of A and B in the following:

(a) $\frac{4}{5} - \frac{A}{15} = \frac{2}{15}$

$\frac{12}{15} - \frac{4A}{15} = \frac{2}{15}$ M1

Answer: $A =$ 10 [2] A1

(b) $\frac{3}{7} \div \frac{B}{11} = \frac{11}{7}$

$\frac{3}{7} \times \frac{11}{B} = \frac{11}{7}$ M1

Answer: $B =$ 3 [2] A1

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5. Expand and simplify the following:

(a) $5(4x + 8)$

Answer: $20x + 40$ B1 B1 [2]

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

$= a^2 - 3ab - 8ab + 20b$

Answer: $a^2 - 11ab + 20b$ B1 B1 B1 [3]

(c) $(2x + 4)(3x - 7)$

$= 6x^2 - 14x + 12x - 28$

Answer: $6x^2 - 2x - 28$ B1 B1 B1 [3]

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6. A pack of 40 cards is made up of red and black cards. The probability that a red card is chosen at random is $\frac{3}{8}$. Calculate how many black cards there are in the pack.

$\frac{5}{8} \times 40$ M1

Answer: 25 [2] A1

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7. (a) The angles in a triangle are in the ratio 10 : 3 : 5. Calculate the size of the largest angle.

18 parts → 180°] M1 for either of these 2 steps
1 part → 10°
10 parts → 10 × 10°

Answer: 100 [2] A1

(b) The ratio of Mark's age to Chris's age is 3 : 4. Calculate how old Chris is if he is 7 years older than Mark.

$c = m + 7$
$c = \frac{4m}{3}$] M1 for either of these 2 lines or any sensible method.

$\frac{4m}{3} = m + 7$

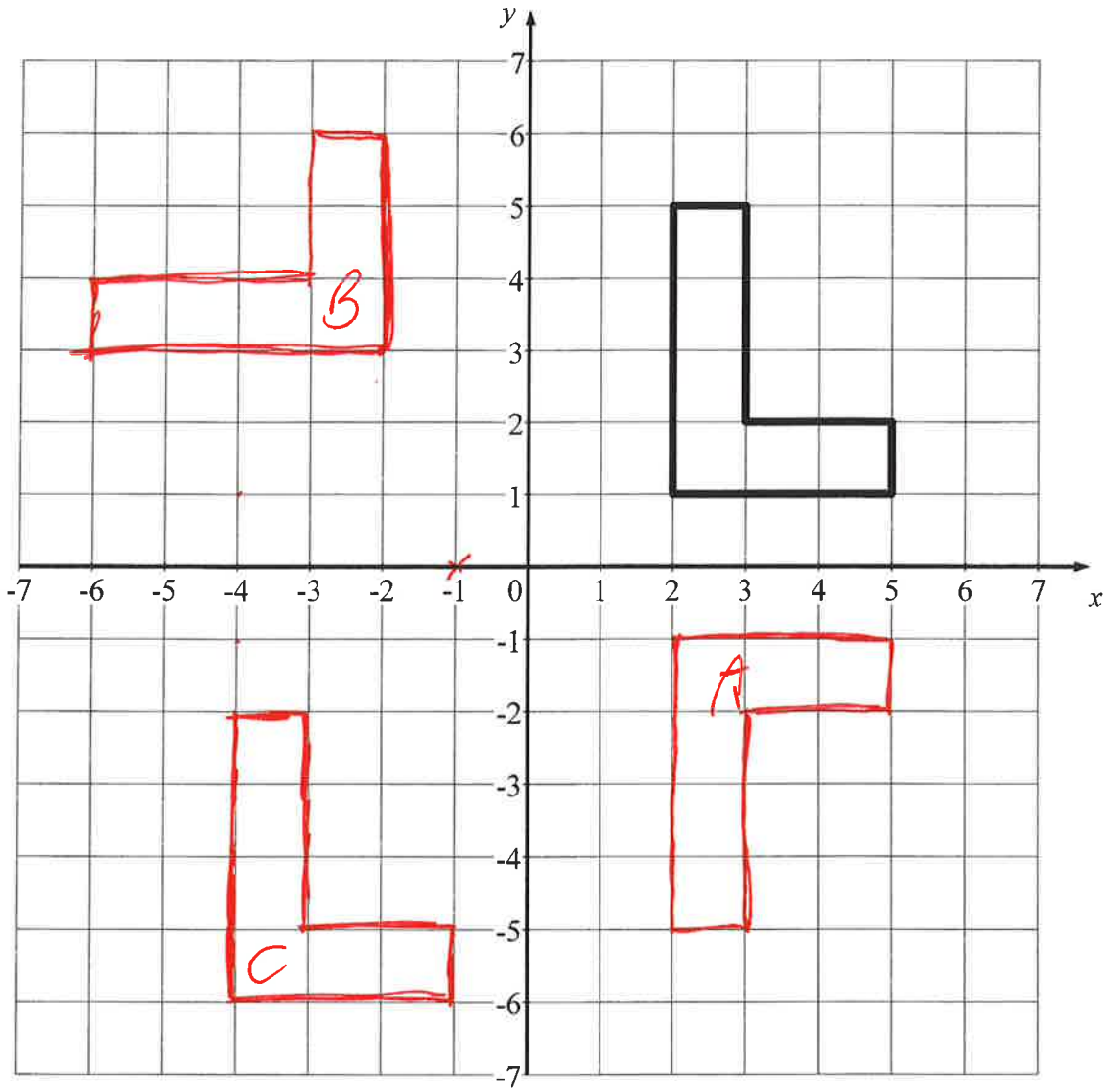
$4m = 3m + 21$

$m = 21$

Answer: 28 [2] A1

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8. An L shape is drawn on the graph below:



On the graph:

(a) reflect the L shape in the x axis labelling this shape A, [2]

B2

S.C. Correct reflection in y axis scores B1 B0

(b) rotate the **original** L shape 90° anticlockwise about the point $(-1, 0)$ labelling this shape B, [2]

B1 correct rotation
B1 correct location

(c) translate the **original** L shape by the vector $\begin{pmatrix} -6 \\ -7 \end{pmatrix}$ labelling this shape C. [2]

B1 correct horizontally
B1 correct vertically

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9. The diagram below shows 3 right angled triangles. Calculate the lengths marked x and y, giving your answers to 3 significant figures where appropriate.

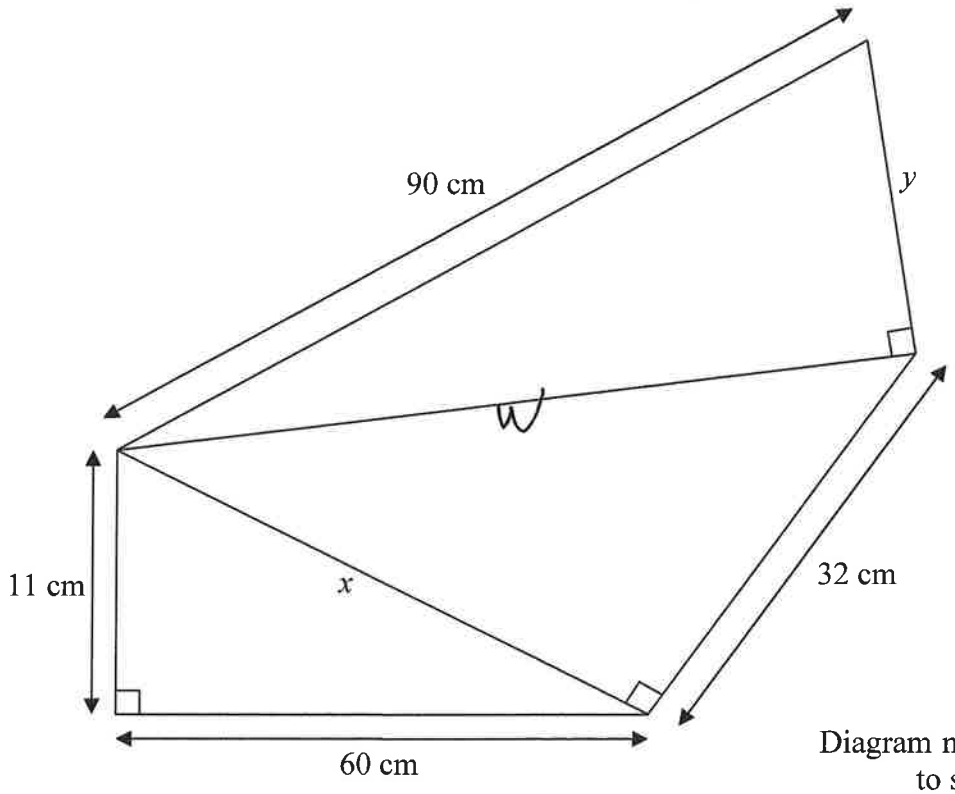


Diagram not drawn to scale

allow their w

$x^2 = 11^2 + 60^2$ M1

$x^2 = 3721$

$x = \sqrt{3721} = 61$

$w^2 = x^2 + 32^2$

$w^2 = 3721 + 1024 = 4745$

$w = 68.88...$

$y^2 + "4745" = 90^2$ M1

$y^2 = 8100 - 4745$

$y^2 = 3355$

$y = \sqrt{3355}$

Answer: $x =$ 61 $y =$ 57.9 [4] A2

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10. Factorise $49xy^2 + 21xy$

B1 B1

Answer: $7xy(7y+3)$ [2]

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11. (a) The test scores of six students were:

5, 7, 0, 5, 17, 8

Calculate the mode, median and mean for these test scores.

0, 5, 5, 7, 8, 17

$\text{mean} = \frac{0+5+5+7+8+17}{6}$ M1 $= \frac{42}{6}$

mode = 5, median = 6, mean = 7 [4] A3

(b) The total weight of 5 rugby players is 425 kg and the mean weight of 10 badminton players is 50.5 kg. Calculate the mean weight of all 15 players.

total badminton weight = $10 \times 50.5 = 505$ M1

total weight = $425 + 505 = 930$

$\text{mean} = \frac{\text{"930"}}{15}$ M1 with their total weight

Answer: 62 kg [3] A1

(c) The mean age of three people is 22 years old and their median age is 20. The range of their ages is 16 years. Calculate the age of the youngest person.

x , 20 , $x + 16$] M1

$\text{mean} = \frac{2x + 36}{3} = 22$] M1

$2x + 36 = 66$

$2x = 30$

$x = 15$

Answer: 15 [3] A1

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12. Solve the following equations for x:

(a) $3x - 5 = 5x + 6$

$-11 = 2x$ M1 for either side correct

$x = \frac{-11}{2}$ or -5.5 [2] A1

(b) $4(2x - 6) = 3x$

$8x - 24 = 3x$ M1 and a 'sensible' attempt to solve

$5x = 24$

$x = \frac{24}{5}$ or 4.8 [2] A1

(c) $\frac{2x}{5} = -8$

$2x = -40$ M1

$x = -20$ [2] A1

(d) $(x + 2)(x - 5) = x(x - 7)$

$x^2 - 5x + 2x - 10 = x^2 - 7x$ M1 for both sides correct

$-3x - 10 = -7x$ M1 for cancellation of x^2's and 'sensible' attempt to solve.

$4x = 10$

$x = \frac{10}{4}$

$x = \frac{5}{2}$ or 2.5 or $10/4$ [3] A1

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13. The diagram below shows an overlapping triangle and parallelogram, with the parallel lines indicated by the arrows. Calculate the size of the angles marked x and y

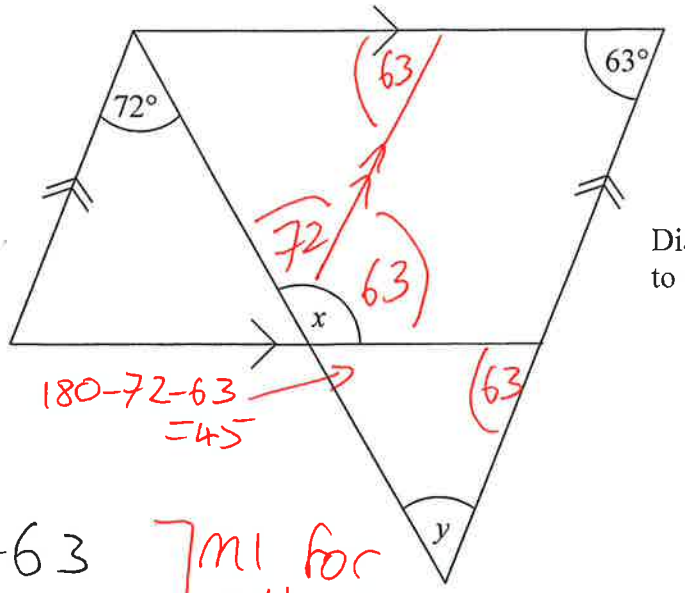


Diagram not drawn to scale

$x = 72 + 63$

$y = 180 - 45 - 63$

M1 for either line

A1 A1

Answer: $x =$ 135 $y =$ 72 [3]

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14. The diagram below shows a regular polygon.

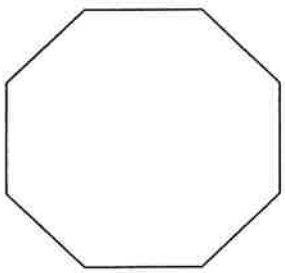


Diagram not drawn to scale

(a) Write down the name of this polygon.

Answer: octagon [1] B1

(b) Calculate the size of the interior and exterior angles for this polygon.

interior angle = 180 − "45" = 135 M1 allow their "45"

exterior angle = $\frac{360}{8}$ = 45 M1

Answer: interior angle = 135 A1, exterior angle = 45 A1 [4]

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15. The diagram below shows a triangular based prism. The triangle forming the base is a right angled triangle. The volume of this prism is 108 cm^3.

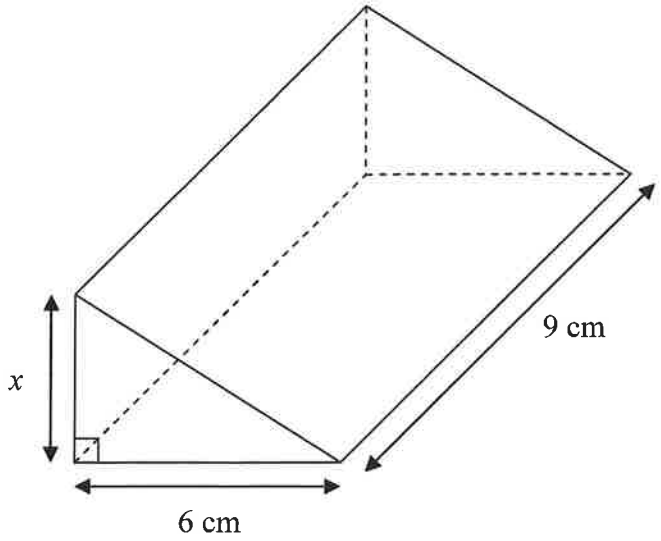


Diagram not drawn to scale

Calculate the value of x.

m1

$\left(\frac{1}{2} \times 6 \times x\right) \times 9 = 108$

m1 for ×9 and sensible method to solve.

$27x = 108$

$x = \frac{108}{27}$

Answer: 4 cm [3] A1

16. After a test there are 180 test papers to be marked. It would take Adam 30 minutes to mark all the papers whilst it would take Brian 45 minutes to mark them all.

(a) Calculate how many test papers Adam marks per minute.

$\frac{180}{30}$ M1

Answer: 6 [2] A1

(b) Calculate how many minutes it would take them to mark the papers if they did so together.

Brian $\frac{180}{45}$ = 4 papers per min

M1

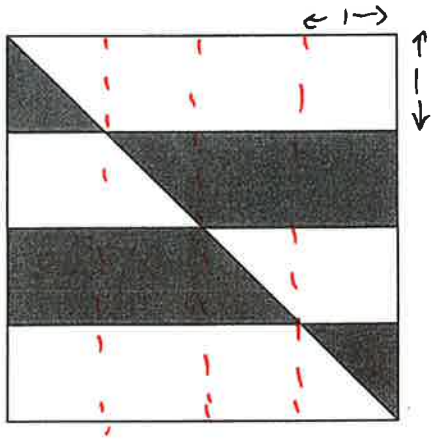
Adam + Brian = 6 + 4 = 10

Time = $\frac{180}{\text{"10"}}$] M1

using their "6+4"

Answer: 18 minutes [3] A1

17. The diagram below shows a square divided by three equally spaced horizontal lines and a single diagonal line. Calculate the fraction of the square which is shaded.



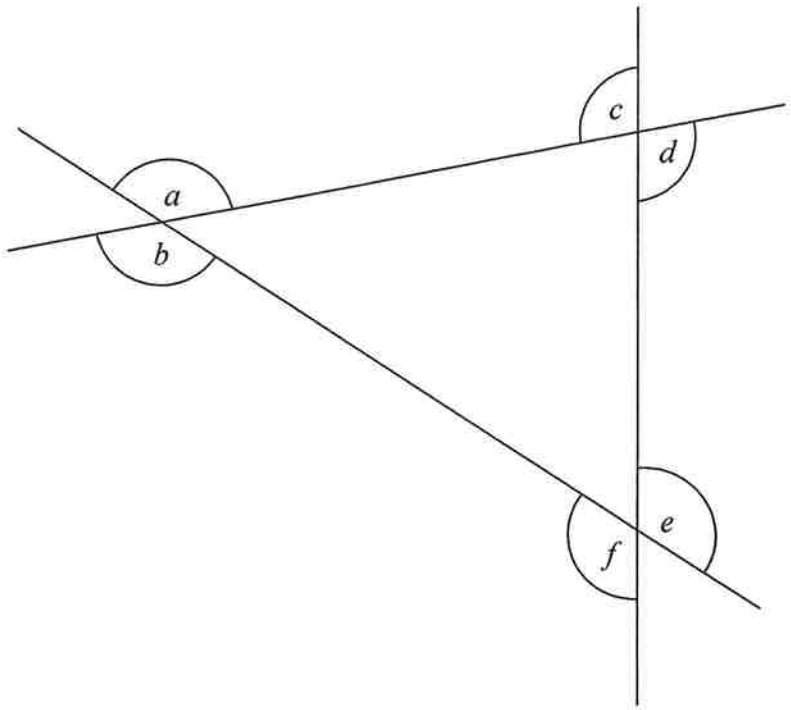
$A = \frac{1}{2} + 2.5 + 2.5 + \frac{1}{2} = 6$ M1 for any sensible method

Fraction = $\frac{6}{16}$

Fraction of square shaded: $\frac{6}{16}$ or $\frac{3}{8}$ [2] A1

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18. The diagram below shows 3 intersecting lines.



Calculate the value of $a+b+c+d+e+f$.

$(a+b+c+d+e+f) + \underbrace{2\times 180}_{\text{2x 'sum of angles in a triangle'}} = 3\times 360$ M1 for LHS or RHS

Answer: 720 [2] A1

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19. Find the biggest number which is less than 50 and is the product of three different prime numbers.

$2\times 3\times 7$ M1

Answers: 42 [2] A1

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20. The shape below is formed by a straight line of length 20 cm and two quarter circles with the same radius.

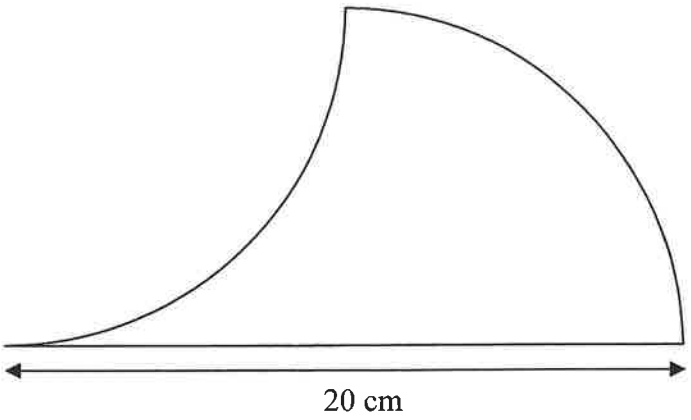


Diagram not drawn to scale

For the above shape calculate, to 3 significant figures, the:

(a) perimeter,

$2 \times \left(\frac{2\pi \times 10}{4}\right)$ m1 for attempting to use "$2\pi r$"

$+ 20$ m1

Answer: 51.4 cm [3] A1

(b) area.

$\frac{\pi \times 10^2}{4}$ m1 for attempting to use "πr^2"

$+ \left(10 \times 10 - \frac{\pi \times 10^2}{4}\right)$ m1

Answer: 100 cm^2 [3] A1

Page total: 6

21. The diagram below shows 2 overlapping squares with regions A, B and C as shown. Calculate the difference between the areas of the regions A and C.

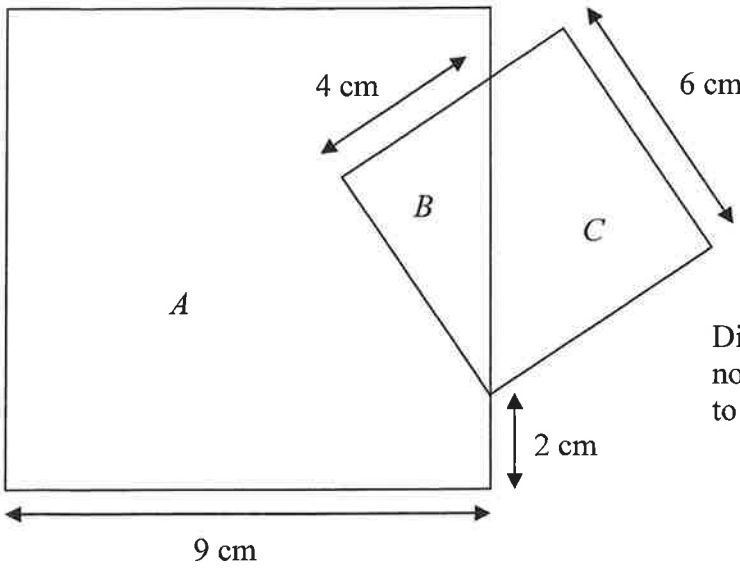
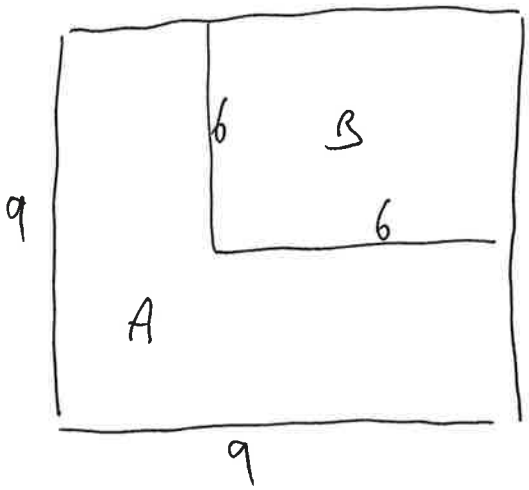


Diagram not drawn to scale



$A = 9^2 - 6^2$ m1

$= 81 - 36$ m1

$C = 0$

Answer: 45 cm^2 [3] A1

22. The diagram below shows a square contained within a circle which is contained inside another square. The length of each side for the smaller square is $\sqrt{8}$ cm.

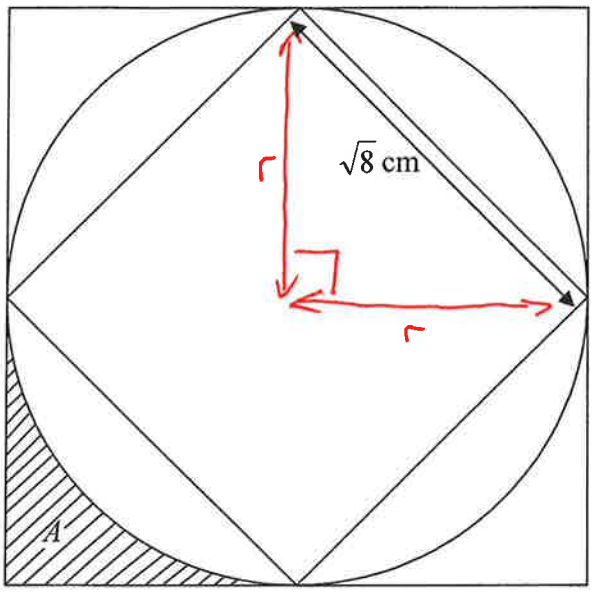


Diagram not drawn to scale

Calculate the perimeter of the shaded area A, writing your answer to 3 significant figures.

$r^2 + r^2 = (\sqrt{8})^2$ M1

$2r^2 = 8$

$r^2 = 4$

$r = 2$ A1

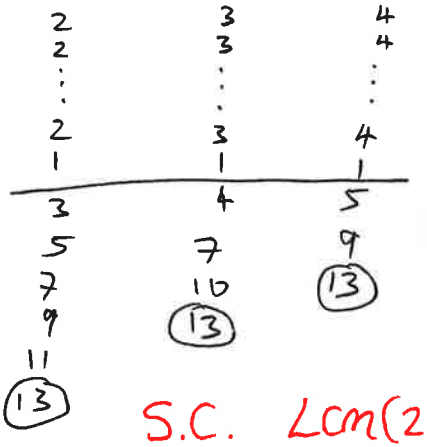
$P = \frac{2 \times \pi \times "2"}{4} + "2" + "2"$ M1 allow their "r"

Answer: 7.14 A1 cm [4]

23. (a) All of the students who study A-level Mathematics at a particular school decide to go on a march. They find that if they walk in pairs, i.e. two students in each row, then there is one student left in the back row. They find similarly that if they walk with three students in each row then there is still one student left in the back row, and that if they walk with four in each row then there is still one student left in the back row.

Calculate the minimum number of students that there could be who study A-level Mathematics at this school.

rows:



Possible total students

or LCM(2,3,4) + 1

M1 for either

S.C. LCM(2,3,4) only scores M1 A0

Answer: 13 [2] A1

(b) Inspired by the Mathematics students' march, all of the students in the school decide to go on a march the following week. In the same way, if all of the students walk in pairs then there is one student left in the back row, but now they find that whether they walk in threes, fours, fives, sixes, sevens, eights or nines, they always have one student left in the back row.

Calculate the minimum number of students who could be at the school in total.

LCM(2, 3, 4, 5, 6, 7, 8, 9) + 1

= 2 × 3 × 2 × 5 × 7 × 3 × 2 + 1

= [illegible] + 1

2520

M1 for any sensible method

2521

Answer: [illegible] cm [2] A1

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