3.18 Area of Compound Shapes: Test Pack

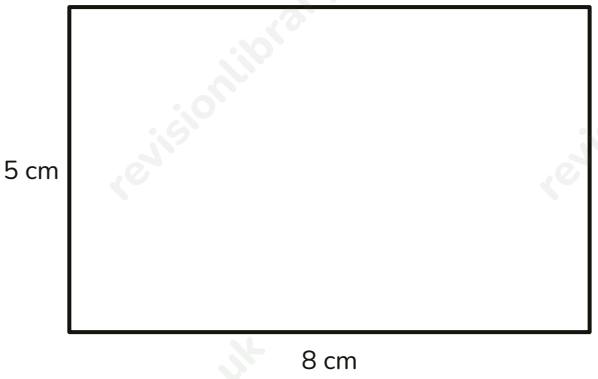
EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the area of a rectangle with length 8 cm and width 5 cm.



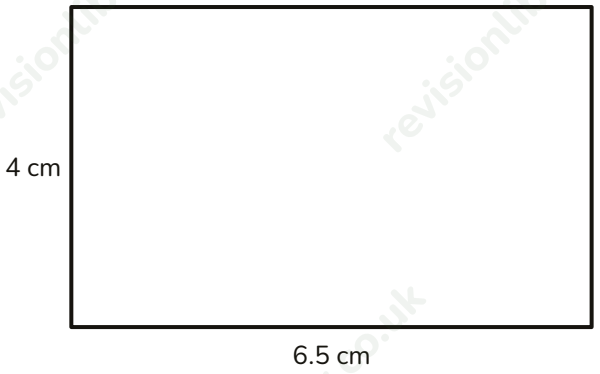
(Total for Question 1 is 1 mark)

2 A rectangle measures 16 cm by 9 cm. A smaller rectangle 5 cm by 4 cm is removed from one corner. Calculate the area of the remaining shape.

(Total for Question 2 is 3 marks)

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3 Work out the area of a rectangle with sides 6.5 cm and 4 cm.



(Total for Question 3 is 2 marks)

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4 A rectangle is 14 cm by 9 cm. A smaller rectangle of height 4 cm and width x cm is removed from one side. The area of the remaining shape is 98 cm². Find x.

(Total for Question 4 is 3 marks)

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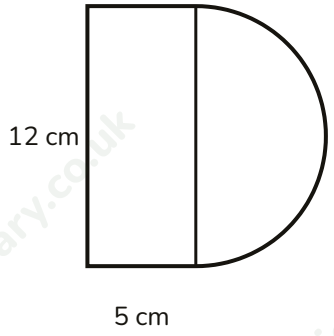
5 A composite shape is formed from three rectangles. Rectangle A is 10 cm by 4 cm, rectangle B is 4 cm by 6 cm attached to the top of A at the left, and rectangle C is 6 cm by 3 cm attached to the right of A. Work out the total area of the composite shape.

(Total for Question 5 is 4 marks)

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6 A rectangle has length 12 cm and width 5 cm. A semicircle with diameter 12 cm is attached to one of the lengths, forming a single shape. Work out the area of the shape. Give your answer to 3 significant figures.

Diagram NOT accurately drawn

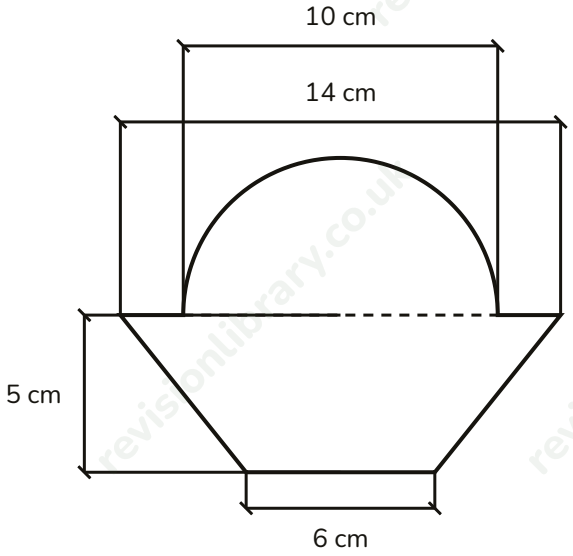


(Total for Question 6 is 2 marks)

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7 A trapezium has parallel sides 14 cm and 6 cm and height 5 cm. A semicircle with diameter 10 cm is attached to the longer parallel side, so that the semicircle lies outside the trapezium. Calculate the area of the combined shape. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

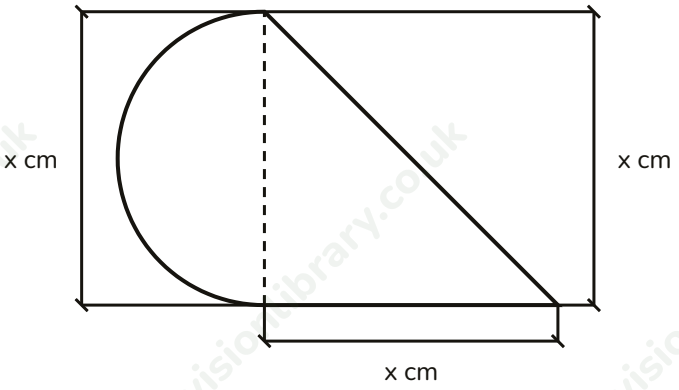


(Total for Question 7 is 4 marks)

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8 A shape consists of a right-angled isosceles triangle with legs of length x cm attached to a semicircle whose diameter is x cm. Express the total area A cm^2 of the shape in terms of x. Hence find the value of x for which A = 100 cm^2. Give answers exact where possible and a decimal to 2 d.p. for x.

Diagram NOT accurately drawn

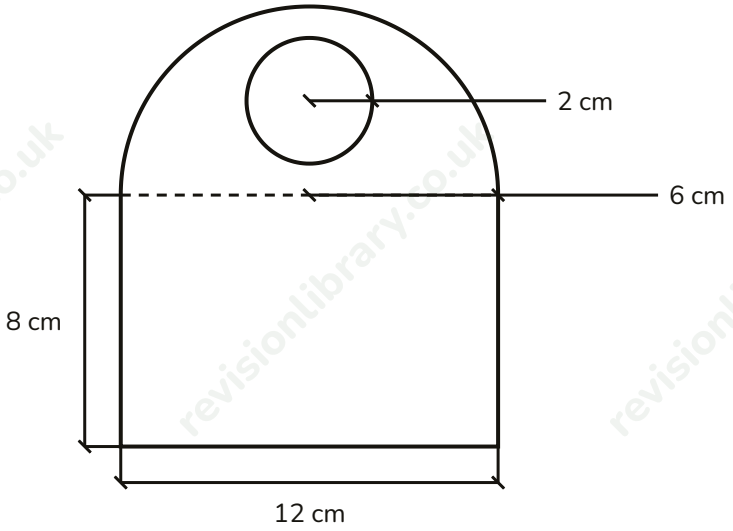


(Total for Question 8 is 5 marks)

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9 A shape is made from a semicircle of radius 6 cm attached to the longer side of a rectangle 12 cm by 8 cm so that the diameter of the semicircle equals the longer side of the rectangle. A circular hole of radius 2 cm is cut out from the semicircular part. Calculate the area of the resulting shape. Give your answer to 1 decimal place.

Diagram NOT accurately drawn

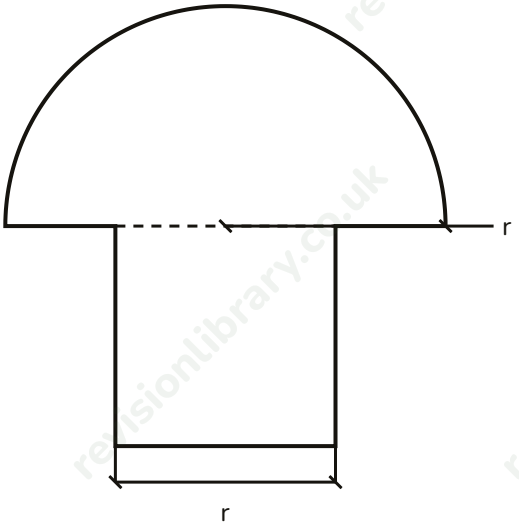


(Total for Question 9 is 6 marks)

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10 Show that the area of a shape formed by a semicircle of radius r attached to a square of side r is $A = r^2 + (1/2)\pi r^2$. Hence, for r = 3 cm, calculate the percentage of the total area that is contributed by the semicircle. Give your answer to 1 decimal place.

Diagram NOT accurately drawn

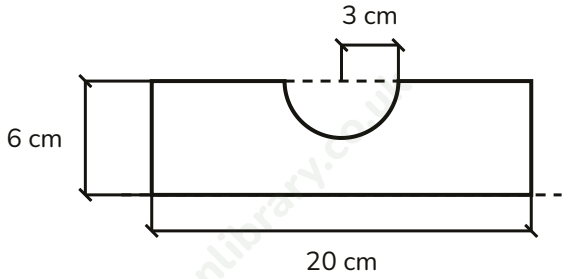


(Total for Question 10 is 7 marks)

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11 A compound shape consists of a rectangle 20 cm by 6 cm with a semicircle removed from the centre of one long side. The semicircle has radius 3 cm. The remaining outline is then rotated about the opposite long side to form a solid. Find the volume of the solid formed. Give your answer in terms of π and as a decimal to 2 decimal places. (Treat the semicircular notch as removed before rotation.)

Diagram NOT accurately drawn



(Total for Question 11 is 6 marks)

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Mark scheme · 3.18 Area of Compound Shapes: Test Pack

Question 1

40 cm² cao	**B1**

Answer: 40 cm^2 (or 40)

Question 2

use 16×9 - 5×4 or equivalent method	**M1**
compute areas: 144 and 20	**M1**
124 cm² cao	**A1**

Answer: 124 cm^2

Question 3

multiply 6.5×4 or show method	**M1**
26.0 cm² cao	**A1**

Answer: 26.0 cm^2

Question 4

form equation 14×9 - 4x = 98 or equivalent	**M1**
solve to get 126 - 4x = 98 -> 4x = 28	**M1**
x = 7 cm cao	**A1**

Answer: 7 cm

Question 5

area A = 10×4 = 40 shown	**M1**
area B = 4×6 = 24 shown	**M1**
area C = 6×3 = 18 shown	**M1**
total area = 40 + 24 + 18 = 82 cm² cao	**A1**

Answer: 82 cm^2

Question 6

area method: area rectangle + area semicircle, substitute values (oe)	**M1**
area = 12*5 + (1/2)*π*$(6)^2$ = 60 + 1/2*π*36 = 60 + 18pi, answer to 3 s.f. 60 + 18pi = 60 + 56.5487... = 116.549... -> 117	**A1**

Answer:117 cm^2 (awrt, 3 s.f.) (117 cao)
Recompute: 18pi = 56.5487..., total 116.5487... rounds to 117 to 3 s.f..

Question 7

area trapezium = 1/2*(14+6)*5 = 1/2*20*5 = 50	**M1**
area semicircle = 1/2*π*$(5)^2$ = 12.5pi	**M1**
sum = 50 + 12.5pi	**A1**
decimal: 50 + 12.5pi = 50 + 39.2699... = 89.3 cm² (1 d.p.)	**A1**

Answer:89.3 cm^2 (1 d.p.).
Working check: trapezium 50, semicircle 12.5pi = 39.2699..., total 89.2699... -> 89.3.

Question 8

area triangle (right isosceles) = 1/2 * x * x = $x^2/2$ and area semicircle = 1/2 * π * $(x/2)^2$ = π*$x^2/8$	**M1**
sum A = $x^2/2$ + π*$x^2/8$ = x^2*(1/2 + π/8)	**M1**
A = x^2*(4/8 + π/8) = x^2*((4+π)/8) cao	**A1**
set x^2*(4+π)/8 = 100 and rearrange x^2 = 800/(4+π)	**M1**
x = √800/(4+&π;) = decimal 10.58 cm (2 d.p.)	**A1**

Answer:A = x^2*(4+π)/8. For A = 100: x^2 = 800/(4+π), so x = √800/(4+&π;) = 10.58 cm (2 d.p.).
Working check: 4+π = 7.141592654, 800/7.141592654 = 112.0198..., sqrt = 10.5839... -> 10.58 (2 d.p.).

Question 9

area rectangle = 12*8 = 96	**M1**
area semicircle radius 6 = 1/2*π*6^2 = 18pi	**M1**
area hole = π*2^2 = 4pi; subtract from semicircle	**M1**
total area = 96 + 18pi - 4pi = 96 + 14pi	**M1**
evaluate: 14pi = 43.9823..., total = 139.9823...	**A1**
to 1 d.p. 140.0 cm²	**A1**

Answer:140.0 cm^2 (1 d.p.).
Working check: 14pi = 43.9823..., add 96 = 139.9823... -> 140.0.

Question 10

area square = r^2 and area semicircle = 1/2*π*r^2 identified	**M1**
sum A = r^2 + 1/2*π*r^2 = r^2*(1 + π/2) cao	**A1**
substitute r = 3: area semicircle = 1/2*π*9 = 4.5pi, total area = 9 + 4.5pi	**M1**
compute numeric semicircle area and total area	**M1**
semicircle = 4.5pi = 14.1372..., total = 9 + 14.1372... = 23.1372...	**A1**
percentage = (semicircle/total)*100	**M1**
compute percentage = 14.1372.../23.1372... *100 = 61.1% (1 d.p.)	**A1**

Answer: Show that: A = r^2 + 1/2*π*r^2 = r^2*(1 + π/2). For r = 3: semicircle = 4.5pi = 14.1372..., total = 23.1372..., percentage = 14.1372.../23.1372...*100 = 61.1% (1 d.p.).

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Question 11

interpret rotation: volume from rotating rectangle around long side gives cylinder radius 6 and length 20? Check correct axis: opposite long side -> rectangle height 6 rotates to make cylinder radius 6 and length 20. Volume cylinder = $\pi*r^2*h = \pi*6^2*20 = 720pi$ **M1**

semicircular notch radius 3 is centred on one long side; when rotated about opposite long side it generates a solid equal to a full sphere of radius 3? Need careful method: distance between the notch and axis = 6 (height) so profile generates a toroidal segment. Simpler: use Pappus centroid theorem or recognise shape is cylinder minus solid of revolution of semicircle around parallel axis distance 6. Use Pappus: volume = area of semicircle * distance travelled by its centroid **M1**

area semicircle = $1/2*\pi*3^2 = 4.5pi$; centroid of semicircle from its flat edge is $4r/(3pi) = 4*3/(3pi) = 4/\pi$. The flat edge lies on the long side being rotated, at distance 6 from the axis, and the notch bulges inward (towards the axis), so the centroid is closer to the axis: distance from axis = $6 - 4/\pi$ **M1**

distance travelled = $2pi*(6 - 4/\pi) = 12pi - 8$ **M1**

volume removed = area * distance = $4.5pi * (12pi - 8) = 54pi^2 - 36pi$ **A1**

final volume = $720pi - (54pi^2 - 36pi) = 720pi + 36pi - 54pi^2 = 756pi - 54pi^2$. Decimal evaluate: $756pi = 2375.044...$; $54pi^2 = 54*(9.8696044) = 532.959...$; subtract = 1842.085... -> 1842.09 cm^3 (2 d.p.) **A1**

Answer:Volume = $756pi - 54pi^2$ cm^3 (exact). Decimal: 1842.09 cm^3 (2 d.p.).

Working check: $756pi = 2375.044...$, $54pi^2 = 532.959...$, difference 1842.085... -> 1842.09.

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