3.16 Area and Circumference of Circles: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the circumference of a circle with radius 7 cm. Use $\pi = 3.14$.

(Total for Question 1 is 1 mark)

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2 A circle has an area of $121\ \pi\ \text{cm}^2$.
Work out the diameter of the circle.

(Total for Question 2 is 3 marks)

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3 Work out the radius of a circle whose circumference is 18.84 cm. Use $\pi = 3.14$ and give your answer to 1 decimal place.

(Total for Question 3 is 2 marks)

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4 The circumference of a circular track is 62.8 m. Use $\pi = 3.14$. Work out the diameter of the track, giving your answer to 1 decimal place.

(Total for Question 4 is 4 marks)

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5 A circular sticker has circumference 18.84 cm. Use $\pi = 3.14$. Work out the area of the sticker. Give your answer to 2 decimal places.

(Total for Question 5 is 4 marks)

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6 A circular water tank has area 200.96 m². Use $\pi = 3.14$.

(a) Work out the radius of the tank to 2 decimal places. **(3)**

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(b) Hence work out the circumference of the tank to 2 decimal places. **(3)**

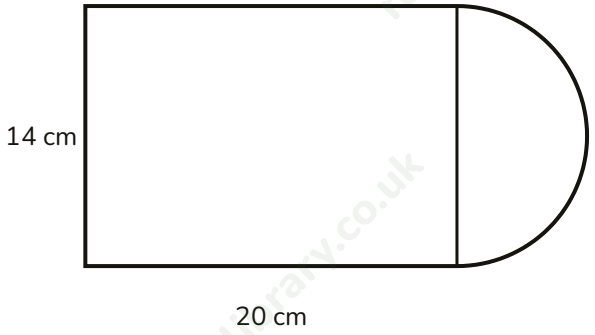
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(Total for Question 6 is 6 marks)

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7 A small playing surface is made from a rectangle of length 20 cm and width 14 cm with a semicircle attached to one width so that the diameter of the semicircle equals the width. Find the perimeter of the whole shape (the outer boundary). Give your answer in terms of π.

Diagram NOT accurately drawn



(Total for Question 7 is 6 marks)

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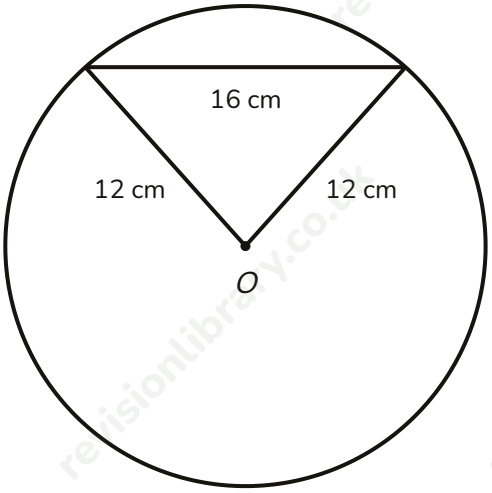
8 Show that the length of the chord where the line $y = 3$ intersects the circle $x^2 + y^2 = 49$ is $4\sqrt{10}$. Give clear working.

(Total for Question 8 is 8 marks)

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9 A circle has centre O and radius 12 cm. A chord of the circle has length 16 cm. Find the area of the isosceles triangle formed by the two radii to the chord endpoints and the chord. Give your answer exactly in simplest surd form.

Diagram NOT accurately drawn



(Total for Question 9 is 12 marks)

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Mark scheme · 3.16 Area and Circumference of Circles: Test Pack

Question 1

circumference = 2 * π * 7 = 2 * 3.14 * 7 = 43.96 cm; 43.96 or 44.0 awrt	**B1**

Answer: 43.96 cm (or 44.0 cm awrt 2 sf/1 dp acceptable). The mark scheme accepts 43.96 cao or rounded to 44.0 awrt if a calculator is used and rounding shown explicitly in working (or implied by display).

Question 2

$\pi r^2 = 121\ \pi$ so $r^2 = 121$	**M1**
$r = 11$	**M1**
22 cm	**A1**

Answer: 22 cm

Question 3

use circumference = 2 * π * r, so r = circumference / (2 * π)	**M1**
r = 18.84 / (2 * 3.14) = 3.0 cm cao (18.84 / 6.28 = 3.0)	**A1**

Answer: 3.0 cm

Question 4

use C = π * d, so d = C / π	**M1**
substitute: d = 62.8 / 3.14	**M1**
d = 20.0 m cao (62.8 / 3.14 = 20.0)	**A1**
final answer given with units m	**B1**

Answer: 20.0 m

Question 5

find radius from circumference: r = C / (2 * π)	**M1**
substitute r = 18.84 / (2 * 3.14) = 3.0	**M1**
use area = π * r^2 and substitute: 3.14 * 3.0^2	**M1**
area = 28.26 cm² => 28.26 cm² to 2 dp = 28.26 cm² cao	**A1**

Answer: 28.26 cm^2

Question 6

(a) use r = √area / &π;	**M1**
(a) substitute: r = $\sqrt{200.96 / 3.14}$	**M1**
(a) r = 8.00 m cao (200.96 / 3.14 = 64.00; $\sqrt{64.00}$ = 8.00)	**A1**

(a) Answer: 8.00 m

(b) use C = 2 * π * r with r from part (a)	**M1**
(b) substitute: C = 2 * 3.14 * 8.00	**M1**
(b) C = 50.24 m cao (2 * 3.14 * 8 = 50.24)	**A1**

(b) Answer: 50.24 m

Question 7

identify which sides are on the outer boundary: two lengths 20, one width 14 and semicircular arc	**M1**
find semicircle arc length = half circumference = (1/2) x 2 π r = π r with diameter 14 so r = 7	**M1**
compute semicircle arc = 7 π	**M1**
sum the straight sides: 20 + 20 + 14 = 54	**M1**
final exact perimeter 54 + 7 π cao	**A1**
units: cm	**B1**

Answer: 54 + 7 π cm

Question 8

substitute y = 3 into $x^2 + y^2 = 49$ to obtain $x^2 + 9 = 49$ or $x^2 = 40$	**dM1**
take square root to find $x = \pm \sqrt{40}$	**M1**
simplify $\sqrt{40} = 2\sqrt{10}$	**A1**
chord length = difference between x-coordinates = 2 x where $x = 2\sqrt{10}$	**dM1**
compute chord length = $2x = 4\sqrt{10}$	**M1**
$4\sqrt{10}$ cao	**A1**
clear statement linking substitution to chord length	**B1**
correct final presentation, no units required	**B1**

Answer: $4\sqrt{10}$

Question 9

identify relationship: chord length c = 2 R sin(θ/2); substitute c = 16, R = 12 to get sin(θ/2) = 16/(2x12) = 16/24 = 2/3; alternatively, using Pythagoras: draw or use the perpendicular from O to the chord, bisecting the isosceles triangle into two right-angled triangles. Award each marking point once, using either route; a fully correct Pythagoras solution earns all 12 marks, including steps implied by correct working.	**M1**
state θ/2 satisfies sin(θ/2) = 2/3 and so $\cos(\theta/2) = \sqrt{1 - (2/3)^2} = \sqrt{5}/3$; alternatively, using Pythagoras: halve the chord to obtain a right-triangle base of 16/2 = 8 cm	**M1**
use double-angle identity sin θ = 2 sin(θ/2) cos(θ/2); alternatively, using Pythagoras: use Pythagoras to relate the perpendicular height to the radius and half-chord	**M1**
substitute values to get sin θ = 2 x (2/3) x ($\sqrt{5}$/3) = 4 $\sqrt{5}$ / 9; alternatively, using Pythagoras: substitute to obtain height squared = $12^2 - 8^2 = 80$	**M1**
use triangle area formula for two sides R and included angle θ: area = (1/2) R^2 sin θ; alternatively, using Pythagoras: take the positive square root to obtain height = $\sqrt{80}$ cm	**M1**
substitute R = 12 and sin θ = 4 $\sqrt{5}$ / 9 to get area = 1/2 x 144 x (4 $\sqrt{5}$ / 9); alternatively, using Pythagoras: use area = (1/2) x chord x perpendicular height	**M1**
simplify: 72 x (4 $\sqrt{5}$ / 9) cao; alternatively, using Pythagoras: simplify the height to 4 $\sqrt{5}$ cm cao	**A1**
further simplification: (288 $\sqrt{5}$) / 9 cao; alternatively, using Pythagoras: substitute into the area formula to obtain (1/2) x 16 x 4 $\sqrt{5}$	**A1**
reduce fraction: 32 $\sqrt{5}$ cao; alternatively, using Pythagoras: simplify the area to 32 $\sqrt{5}$ cao	**A1**
show exact surd form and state units cm^2	**B1**
clear logical sequence linking chord to area (AO3 communication)	**B1**
final answer 32 $\sqrt{5}$ cm^2 cao	**A1**

Answer: 32 $\sqrt{5}$ cm^2

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