

Circles: practice solutions, Grade 10 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Parts of a circle



- (a) $r = d \div 2 = 14 \div 2 = 7$ ft.
- (b) The longest chord of a circle is a diameter, so it is **14** ft.
- (c) A line that meets the circle at exactly one point is a **tangent**.

2 A tangent and a radius



The radius OT is perpendicular to the tangent, so triangle OTP is right-angled at T .

$$PT^2 = OP^2 - OT^2 = 625 - 49 = 576, \text{ so } PT = 24 \text{ cm.}$$

3 Central and inscribed angle



- (a) A central angle equals its intercepted arc: **112°** .
- (b) An inscribed angle is half the arc: **$112^\circ \div 2 = 56^\circ$** .

4 Angle in a semicircle



An angle inscribed in a semicircle is a right angle, so $m\angle C = 90^\circ$.

The angles of a triangle add up to 180° , so $m\angle B = 180 - 90 - 37 = 53^\circ$.

5 Length of an arc



A 60° arc is $\frac{60}{360} = \frac{1}{6}$ of the circle.

$$\ell = \frac{1}{6} \cdot 2\pi \cdot 6 = 2\pi \approx 6.28 \text{ cm.}$$

6 Area of a sector



$$A = \frac{90}{360} \cdot \pi \cdot 10^2 = \frac{1}{4} \cdot 100\pi = 25\pi \approx 78.5 \text{ ft}^2.$$

The sprinkler waters about **78.5** square feet.

7 Writing an equation



$$(x - (-1))^2 + (y - 4)^2 = 3^2, \text{ that is } (x + 1)^2 + (y - 4)^2 = 9.$$

For $(2, 4)$: $(2 + 1)^2 + (4 - 4)^2 = 9 + 0 = 9$. The equation is satisfied, so the point lies on the circle.

8 Distance to a chord



The perpendicular from the center bisects the chord, so a right triangle has hypotenuse **13** and one leg **12**.

$$d^2 = 13^2 - 12^2 = 169 - 144 = 25, \text{ so } d = 5 \text{ in.}$$

9 Two tangent segments



Tangent segments from the same external point are congruent: $3x + 2 = 5x - 10$.

Then $12 = 2x$, so $x = 6$. $PA = 3(6) + 2 = 20$ and $PB = 5(6) - 10 = 20$. Each segment is **20** units long.

10 Triangle inscribed in a circle



Each angle is half the arc it intercepts (the arc opposite to it).

$$m\angle C = \frac{1}{2}(100) = 50^\circ, m\angle A = \frac{1}{2}(130) = 65^\circ, m\angle B = \frac{1}{2}(130) = 65^\circ.$$

Check: $50 + 65 + 65 = 180$. Angles A and B are equal, so the triangle is isosceles with $CA = CB$.

11 Pizza slices



The radius is 8 in and each slice has a central angle of $360 \div 8 = 45^\circ$.

$$(a) A = \frac{45}{360} \cdot \pi \cdot 64 = 8\pi \approx 25.1 \text{ in}^2.$$

$$(b) \ell = \frac{45}{360} \cdot 2\pi \cdot 8 = 2\pi \approx 6.3 \text{ in}.$$

12 Angles from secants and tangents



$$(a) \text{ Outside the circle: } \frac{1}{2}(110 - 40) = 35^\circ.$$

$$(b) \text{ The vertex is on the circle, so the angle is half the intercepted arc: } \frac{1}{2}(148) = 74^\circ.$$

13 Intersecting chords



$$AE \cdot EB = CE \cdot ED, \text{ so } 6 \cdot 4 = 3 \cdot ED.$$

$$24 = 3 \cdot ED, \text{ so } ED = 8.$$

14 Circle from a diameter

The center is the midpoint: $\left(\frac{-2+6}{2}, \frac{3+9}{2}\right) = (2, 6)$.

$$AB = \sqrt{8^2 + 6^2} = 10, \text{ so } r = 5.$$

$$\text{Equation: } (x - 2)^2 + (y - 6)^2 = 25.$$

15 Ferris wheel

$$\ell = \frac{150}{360} \cdot 2\pi \cdot 30 = \frac{5}{12} \cdot 60\pi = 25\pi \approx 78.5 \text{ ft.}$$

$$\text{In meters: } 78.54 \times 0.3048 \approx 23.9 \text{ m.}$$

16 Completing the square

$$\text{Complete the square: } (x^2 + 8x + 16) + (y^2 - 10y + 25) = -16 + 16 + 25.$$

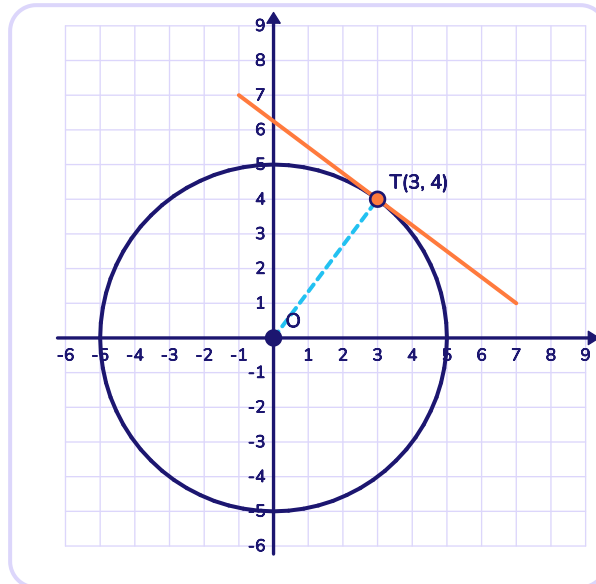
$$(x + 4)^2 + (y - 5)^2 = 25. \text{ It is a circle with center } (-4, 5) \text{ and radius } 5.$$

17 Tangent line to a circle

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The radius OT has slope $\frac{4}{3}$. The tangent is perpendicular to it, so its slope is $-\frac{3}{4}$.

$y - 4 = -\frac{3}{4}(x - 3)$. Multiplying by 4: $4y - 16 = -3x + 9$, so $3x + 4y = 25$.



18 Circle through three points

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The angle at O is a right angle, so the hypotenuse AB is a diameter of the circle through the three points.

Center: midpoint of AB , $(4, 3)$. Diameter: $AB = \sqrt{64 + 36} = 10$, so $r = 5$.

Equation: $(x - 4)^2 + (y - 3)^2 = 25$. Check with O : $16 + 9 = 25$.

19 Circles of a right triangle

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The hypotenuse is $\sqrt{81 + 144} = 15$ cm, and it is a diameter of the circumscribed circle, so $R = 7.5$ cm.

Area = $\frac{1}{2} \cdot 9 \cdot 12 = 54$ cm²; semiperimeter $s = \frac{9 + 12 + 15}{2} = 18$ cm. Then

$r = \frac{54}{18} = 3$ cm.

20 The reef problem



The first path is a tangent of length $t = 30$; the second is a secant with external part $e = 20$.

$$t^2 = w \cdot e, \text{ so } 900 = 20w \text{ and } w = 45 \text{ m.}$$

The part inside the reef is $45 - 20 = 25$ m.

21 Area of a segment



$$\text{Sector area: } \frac{90}{360} \cdot \pi \cdot 64 = 16\pi \approx 50.27 \text{ cm}^2.$$

$$\text{Triangle } AOB \text{ is right-angled with legs } 8 \text{ and } 8: \text{ area} = \frac{1}{2} \cdot 64 = 32 \text{ cm}^2.$$

$$\text{Segment area} = 16\pi - 32 \approx 18.3 \text{ cm}^2.$$

22 Cyclic quadrilateral



Opposite angles are supplementary. $(2x + 10) + (4x - 40) = 180$, so $6x - 30 = 180$ and $x = 35$: $m\angle A = 80^\circ$, $m\angle C = 100^\circ$.

$$(3y + 5) + (5y - 65) = 180, \text{ so } 8y - 60 = 180 \text{ and } y = 30: m\angle B = 95^\circ, m\angle D = 85^\circ.$$

$$\text{Check: } 80 + 100 + 95 + 85 = 360.$$

23 Hexagon in a circle



The hexagon is made of 6 equilateral triangles of side 10. Each has area $\frac{\sqrt{3}}{4} \cdot 100$, so the hexagon has area $150\sqrt{3} \approx 259.8 \text{ in}^2$.

$$\text{Disk: } \pi \cdot 10^2 \approx 314.2 \text{ in}^2.$$

$$\text{Difference: } 314.16 - 259.81 \approx 54.4 \text{ in}^2.$$



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