

GRADE 7 · GEOMETRY · ANSWER KEY

CIRCUMFERENCE OF A CIRCLE

Today's goal: I can find the circumference of a circle to solve problems, including by using the formula for circumference.



How to use this key. Problem numbers match the student sheets. Each answer shows the steps and the slip Mr DJ sees most, so a wrong answer tells you what to reteach. Pepper levels: **Mild** warm-up, **Medium** stretch, **Spicy** challenge, **Extra** Spicy big brain.

Practice

8 problems + Mr DJ's worked example

Use: During the lesson after the deck. Items 1–4 hammer the radius/diameter distinction with the same digits. Item 8 is the semicircle perimeter trap. **Timing:** 15–25 min · pairs or independent · circulate on 3 and 9. Insist on labelling r or d before any formula is written.

- 1 14π cm 2 7π cm 3 14π cm — identical 4 5π m 5 10 cm 6 6π cm
 7 They are different circles — one has radius 7, the other radius 3.5 8 Because the straight diameter edge must be included

1 **MILD** Radius 7 cm?

14π cm

1. $C = 2\pi(7) = 14\pi$ cm.

Watch for: Answered 7π .

2 **MILD** Diameter 7 cm?

7π cm

1. $C = \pi(7) = 7\pi$ cm.

Watch for: Answered 14π by using the radius formula.

3 **MEDIUM** Diameter 14 cm — compare with question 1

14π cm — identical

1. $C = \pi(14) = 14\pi$ cm.

2. Question 1 had radius 7, and $2 \times 7 = 14$, so it is the SAME circle described the other way.

3. Same circle, same circumference, two routes.

Watch for: Answered 28π by putting 14 into $C = 2\pi r$ — the double-doubling error.

4 **MEDIUM** Radius 2.5 m?

5π m

1. $C = 2\pi(2.5) = 5\pi$ m.

2. A decimal radius is no different; the 2 still applies.

Watch for: Answered 2.5π .

5 **MEDIUM** $C = 20\pi$ cm — radius?

10 cm

1. $20\pi = 2\pi r$, so $r = 10$ cm.

2. Or: the coefficient 20 is the diameter, and half of 20 is 10.

Watch for: Answered 20.

6 **MEDIUM** Curved edge of a semicircle, radius 6?

6π cm

1. Full circle: $C = 2\pi(6) = 12\pi$ cm.

2. A semicircle is half of that: $12\pi \div 2 = 6\pi$ cm.

Watch for: Answered 12π , giving the whole circumference.

7 **SPICY** Why do 1 and 2 differ?

They are different circles — one has radius 7, the other radius 3.5

1. Question 1's circle has radius 7, so its diameter is 14.
2. Question 2's circle has diameter 7, so its radius is 3.5.
3. The first circle is twice as wide as the second, so its circumference is twice as large: 14π against 7π .
4. The number 7 means different things in the two questions. Reading which measurement it labels is the whole task.
5. Same number, different role, different circle.

Watch for: Said one of the answers must be wrong. Both are correct; they describe different circles.

8 **SPICY** Why is the perimeter more than 6π ?

Because the straight diameter edge must be included

1. A semicircle is bounded by TWO edges: the curved arc and the straight edge across the bottom.
2. The arc is 6π cm. The straight edge is the diameter, 12 cm.
3. Perimeter = $6\pi + 12$ cm.
4. Perimeter means the whole distance around the shape, and the flat edge is part of that boundary.
5. This is the commonest error with semicircles: halving the circle correctly and then forgetting that halving CREATED a new edge.

Watch for: Gave 6π as the perimeter. Cutting a circle in half produces a straight edge that was not there before, and it counts.

Homework

7 problems + Mr DJ's worked example

Use: Parallels the practice sheet. Item 5 is a deliberate collision with the "Scale drawings" lesson: lengths scale by k , areas by k^2 , and circumference is a length. **Timing:** ~15 min at home · independent · review item 7 as the next-day warm-up; the doubled answer is a recognisable fingerprint.

1 18π cm

2 18π cm — the same as question 1

3 3π m

4 $r = 15$ cm, $d = 30$ cm

5 Twice

6 Because $C = 2\pi r$ is a proportional relationship

7 They used $C = 2\pi r$ with the diameter; correct answer 8π cm

1 **MILD** Radius 9 cm?

18π cm

1. $C = 2\pi(9) = 18\pi$ cm.

Watch for: Answered 9π .

2 **MEDIUM** Diameter 18 cm — notice?

18π cm — the same as question 1

1. $C = \pi(18) = 18\pi$ cm.
2. Question 1 had radius 9, and $2 \times 9 = 18$, so it is the same circle.
3. Two descriptions, one circle, one circumference.

Watch for: Answered 36π by double-doubling.

3 **MEDIUM** Radius 1.5 m?

3π m

1. $C = 2\pi(1.5) = 3\pi$ m.

Watch for: Answered 1.5π .

4 **MEDIUM** $C = 30\pi$ cm — r and d ?

$r = 15$ cm, $d = 30$ cm

1. The coefficient of π is the diameter: $d = 30$ cm.
2. Radius is half: $r = 15$ cm.
3. Check: $C = 2\pi(15) = 30\pi$.

Watch for: Answered $r = 30$, reading the coefficient as the radius.

5 **SPICY** Radius 5 vs radius 10 — how many times longer?

Twice

1. Radius 5: $C = 10\pi$ cm. Radius 10: $C = 20\pi$ cm.
2. $20\pi \div 10\pi = 2$, so the second is exactly twice as long.
3. Doubling the radius doubled the circumference.

Watch for: Answered four times, importing the area rule from the “Scale drawings” lesson. Circumference is a LENGTH, so it scales by the factor itself, not its square.

6 **SPICY** Why does doubling r double C ?

Because $C = 2\pi r$ is a proportional relationship

1. $C = 2\pi r$ means C is 2π multiplied by r , and 2π never changes.
2. So C is proportional to r with constant of proportionality 2π .
3. Multiply r by any number and C is multiplied by the same number — that is what proportionality means.
4. Doubling is just the case where that number is 2: $2\pi(2r) = 2 \times (2\pi r)$.
5. This is exactly the $y = kx$ relationship from the “Recognizing proportional relationships” lesson, with $k = 2\pi$.

Watch for: Explained with one example rather than from the formula. The question asks why it ALWAYS happens.

7 **EXTRA SPICY** Diameter 8, student answered 16π

They used $C = 2\pi r$ with the diameter; correct answer 8π cm

1. The student computed $2 \times \pi \times 8 = 16\pi$.
2. But 8 is the DIAMETER, and $C = 2\pi r$ needs the radius.
3. The radius is 4, so $C = 2\pi(4) = 8\pi$ cm. Or directly: $C = \pi d = 8\pi$ cm.
4. Their answer is exactly twice the correct one, which is the fingerprint of this error — the 8 was already doubled once.
5. The fix is not more care with arithmetic; it is naming which measurement you have before picking a formula.

Watch for: Said the student should have divided by 2 at the end. That works numerically but leaves the wrong method in place.

Exit Ticket

4 problems

Use: End of the circumference lesson. 5–8 min, independent. Items 1 and 3 describe the same circle deliberately; a student giving 10π and 20π has the core error. **Timing:** 5–8 min · independent. Require students to name radius or diameter before writing a formula.

1 10π cm2 6π m3 10π cm — it is the same circle4 $r = 6$ cm, $d = 12$ cm1 **MILD** Radius 5 cm? **10π cm**

1. Given the radius, so use $C = 2\pi r$.
2. $C = 2 \times \pi \times 5 = 10\pi$ cm.

Watch for: Used $C = \pi r$ and answered 5π , forgetting the 2.2 **MILD** Radius 3 m? **6π m**

1. $C = 2\pi r = 2 \times \pi \times 3 = 6\pi$ m.

Watch for: Answered 3π by using $C = \pi r$.3 **SPICY** Diameter 10 cm — and why it matches **10π cm — it is the same circle**

1. Given the diameter, so use $C = \pi d$.
2. $C = \pi \times 10 = 10\pi$ cm.
3. It matches question 1 because a radius of 5 and a diameter of 10 describe the SAME circle: $d = 2r$.
4. The two formulas are one formula. $C = 2\pi r$ becomes $C = \pi d$ the moment you replace $2r$ with d .
5. The trap is putting $d = 10$ into $C = 2\pi r$, giving 20π — that doubles a length that was already doubled.

Watch for: Answered 20π by substituting the diameter into the radius formula. Always name which measurement you were given before choosing the formula.4 **SPICY** $C = 12\pi$ cm — find r and d **$r = 6$ cm, $d = 12$ cm**

1. From $C = 2\pi r$: $12\pi = 2\pi r$.
2. Divide both sides by 2π : $r = 6$ cm.
3. Then $d = 2r = 12$ cm.
4. Shortcut worth noticing: from $C = \pi d$, the diameter is just the coefficient of π . Here $C = 12\pi$, so $d = 12$ immediately.
5. Check: $C = \pi \times 12 = 12\pi$. Correct.

Watch for: Answered $r = 12$ by reading the coefficient as the radius. The coefficient of π is the DIAMETER, so halve it for the radius.

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Frame it: circumference is a perimeter — the distance you would walk around the edge.
2	1:00	Hook — poll 10π vs 20π . Do NOT resolve. 20π is common because $2\pi r$ is the formula students recall first.
3	2:30	Both formulas together, with $d = 2r$ written between them so the equivalence is visible.
4	5:00	WE1 — resolve. Say the diagnostic out loud: an answer exactly twice the right one means d went into the r formula.
5	7:00	Backwards. The coefficient-is-the-diameter shortcut saves time and is rarely taught.
6	10:30	Semicircles. Draw one and trace the boundary with a finger so the straight edge is undeniable.
7		Show the problem and the slip. Pairs: what went wrong, and what is the right answer? Take two answers before moving on.
8		Solve it together, one step at a time. It is also the worked example at the top of the practice sheet, so students can look back at it.
9	9:00	CFU — all-student response. 14π cm. Watch for 7π , which dropped the 2. Whiteboards: everyone tries Mild, then climbs. These are #1, #4, #7 on the practice sheet.
10		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
11	13:00	Launch the in-class practice sheet. Launch the practice sheet. Exit ticket in the last 5–8 minutes.