Unit 11 · Right Triangles in Algebra Cheat Sheet

Unit 11 focus: square roots, the Pythagorean theorem, distance and midpoint

1 SQUARE ROOTS

Find the perfect squares on either side to estimate.

Example: Estimate $\sqrt{55}$.
Between: $\sqrt{49} = 7$ and $\sqrt{64} = 8$
Answer: ≈ 7.4

2 THE PYTHAGOREAN THEOREM

$a^2 + b^2 = c^2$, c is the hypotenuse.

Example: Legs 9 and 12. Hypotenuse?
Square and add: 81 + 144 = 225
Answer: c = 15

3 FINDING A LEG

$b^2 = c^2 - a^2$

Example: Hypotenuse 13, leg 5
Subtract: 169 − 25 = 144
Answer: b = 12

4 IS IT A RIGHT TRIANGLE?

Check whether $a^2 + b^2 = c^2$ with c the longest side.

Example: Sides 8, 15, 17
Check: 64 + 225 = 289 ✓
Answer: Yes

5 DISTANCE AND MIDPOINT

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$; midpoint averages the coordinates.

Example: (1, 2) and (7, 10)
Distance: $\sqrt{36 + 64}$
Midpoint: $(\frac{1+7}{2}, \frac{2+10}{2})$
Answer: d = 10, M = (4, 6)

6 QUICK REMINDERS & COMMON MISTAKES

✓ Do remember

- The hypotenuse is opposite the right angle and longest.
- Square first, add second, square root last.
- Every positive number has two square roots (±).

✗ Common mistakes

- a + b = c: $a^2 + b^2 = c^2$
- Adding when finding a leg: subtract
- Midpoint = difference ÷ 2: sum ÷ 2

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More practice: proportions, special right triangles and trigonometric ratios

1 WRITE A PROPORTION

Similar right triangles have proportional sides (shadows!).

Example: A 6 ft person casts a 4 ft shadow; a tree casts 18 ft.
Proportion: $\frac{6}{4} = \frac{h}{18}$

Answer: 27 ft

2 SPECIAL RIGHT TRIANGLES

Triangle	Side ratio
45°–45°–90°	$1 : 1 : \sqrt{2}$
30°–60°–90°	$1 : \sqrt{3} : 2$

Leg 5 in a 45-45-90: hypotenuse $5\sqrt{2} \approx 7.07$.

3 SOH-CAH-TOA

Ratio	Definition
sine	$\frac{\text{opposite}}{\text{hypotenuse}}$
cosine	$\frac{\text{adjacent}}{\text{hypotenuse}}$
tangent	$\frac{\text{opposite}}{\text{adjacent}}$

4 USING A TRIG RATIO

Choose the ratio that links what you know to what you want.

Example: Hypotenuse 20, angle 30°. Opposite side?
sin 30° = x ÷ 20: x = 20 · 0.5

Answer: 10

5 ANGLES OF ELEVATION AND DEPRESSION

Draw the triangle; the angle is measured from the horizontal.

Example: A ramp rises at 10° over 30 ft horizontally. Height? (nearest tenth)
tan 10° = h ÷ 30: h = 30 tan 10°

Answer: ≈ 5.3 ft

6 CHECK YOURSELF

- Is c the longest side?
- Did I pick opposite and adjacent from the given angle?
- Is my calculator in degree mode?
- Did I round only at the end?