

Geometry and Trigonometry — Free Sample

6 Questions · Easy to Very Hard · Full Solutions · Mistake-Pattern Analysis

Question 1 [EASY]

A rectangle has length 9 and width 6. What is its area?

(Student-produced response)

Algebraic: Area = length times width = 9 times 6 = 54.

Desmos: Not useful. Direct formula substitution.

Faster path: Algebraic, always.

Mistake: **Concept gap**: student adds the dimensions instead of multiplying, computing $9 + 6 = 15$.

Question 2 [EASY]

Two angles are supplementary. If one measures 40 degrees, what is the measure of the other?

(Student-produced response)

Algebraic: Supplementary angles sum to 180 degrees. Other angle = 180 minus 40 = 140 degrees.

Desmos: Not useful. Direct angle relationship.

Faster path: Algebraic, always.

Mistake: **Concept gap**: student subtracts from 90 degrees instead of 180 degrees, confusing supplementary with complementary.

Question 3 [MEDIUM]

In a right triangle, one angle measures 30 degrees and the hypotenuse is 20. What is the length of the side opposite the 30-degree angle?

(Student-produced response)

Algebraic: In a 30-60-90 triangle, the side opposite the 30-degree angle is half the hypotenuse: 20 divided by 2 = 10.

Desmos: Not useful. Recognising the special triangle ratio is faster.

Faster path: Algebraic. The 30-60-90 ratio gives the answer in one step without a calculator.

Mistake: **Concept gap**: student multiplies the hypotenuse by the square root of 3 divided by 2, applying the longer-leg ratio instead of the shorter-leg ratio.

Question 4 [MEDIUM]

A circle has a radius of 6. What is the area of a sector with a central angle of 90 degrees, in terms of pi?

(Student-produced response)

Algebraic: A 90-degree sector is one quarter of the full circle. Full area = pi times 36 = 36 pi. Sector area = 36 pi divided by 4 = 9 pi.

Desmos: Not useful. Recognising 90 degrees as one quarter of 360 degrees gives the fraction directly.

Faster path: Algebraic. One-quarter of the full area is a single multiplication.

Mistake: **Concept gap**: student forgets to take the fraction of the circle area and reports the full circle area of 36 pi.

Question 5 [HARD]

Two similar triangles have areas of 18 and 50. What is the ratio of their corresponding side lengths from smaller to larger?

(Student-produced response)

Shortcut: Scale Factor Powers: area scales as k squared. Side ratio = square root of (18 divided by 50) = square root of (9 divided by 25) = 3 divided by 5.

Solution: The area ratio is 18 to 50, simplified to 9 to 25. Since area scales as the square of the linear scale factor, the side ratio is the square root: 3 to 5.

Mistake: **Concept gap:** student uses the area ratio 18 to 50 directly as the side ratio instead of taking the square root to find the linear scale factor.

Question 6 [VERY HARD]

A circle is given by the equation $x^2 + y^2 - 6x + 4y - 12 = 0$. What is the radius of this circle?

(Student-produced response)

Shortcut: Complete the square for both variables, then read r squared from the right side.

Solution: Group and complete the square: $(x^2 - 6x + 9) + (y^2 + 4y + 4) = 12 + 9 + 4$. This gives $(x - 3)^2 + (y + 2)^2 = 25$. So $r^2 = 25$ and $r = 5$.

Mistake: **Concept gap:** student adds only one completing-the-square constant to the right side and forgets to add the second, producing an incorrect value under the square root.