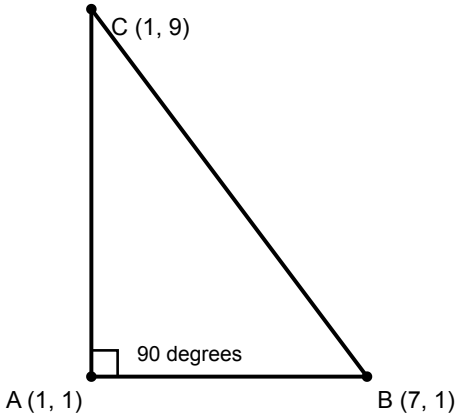
Complementary Angles, Shared Ratios

Use one right triangle to connect sine of one acute angle to cosine of the other

Name: _____ Date: _____

Part 1 - Read One Right Triangle Two Ways

Listen while your teacher reads the launch. In the coordinate diagram, triangle ABC is a right triangle. Complete each ratio from the viewpoint of the named acute angle. Keep the side names in your work so that every numerator and denominator has a clear meaning.



1. The right-angle vertex is _____. The complementary acute angles are _____ and _____.

AB = _____ AC = _____ BC = _____

Expression	Numerator: side and length	Denominator: side and length	Value
sin B			
cos B			
sin C			
cos C			

2. Explain why sin B = cos C. Refer to the same side in both ratios.

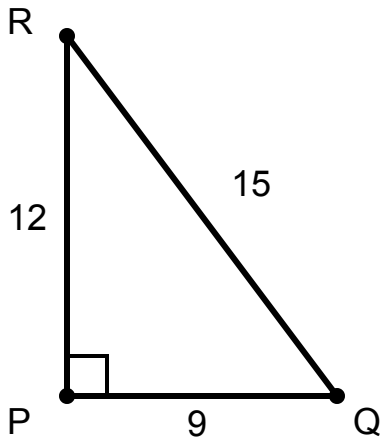
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Part 2 - Apply the Cofunction Relationship

Triangle PQR is right at P. Its side lengths are PQ = 9, PR = 12, and QR = 15. Angles Q and R are complementary.



Expression	Side ratio	Simplified value
sin Q		
cos R		
cos Q		
sin R		

3. Complete: sin Q = cos _____ and cos Q = sin _____.

4. A classmate says, “sin Q and cos Q are equal because both ratios use the hypotenuse.” Explain the error using the numerators.

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Answer Key and Teaching Notes

Materials and setup: Print and supply all student pages, keeping teacher-key pages separate. Provide a pencil for each student; a ruler is optional. No calculator is required. Display or project the Part 1 diagram if possible. Students work independently after the launch, then compare the paired ratios with a partner.

Teaching script: “A sine ratio and a cosine ratio depend on the angle named. In one right triangle, the side opposite one acute angle is adjacent to the other acute angle. Today, prove that idea with side names, not just decimals. First locate the right angle; its opposite side is the hypotenuse.” Ask: “When you switch from angle B to angle C, what happens to side AC?” Expected oral idea: it changes from opposite to adjacent.

Observation method: During Parts 1 and 2, check that students (1) identify A and P as right-angle vertices, (2) use the hypotenuse as the denominator in every sine and cosine ratio, and (3) reverse opposite and adjacent when changing acute angles. Prompt without giving an answer: “Opposite to which angle?” Collect or photograph work and mark each criterion as secure, developing, or needs support.

1. Right-angle vertex: A. Complementary angles: B and C. AB = 6 because the x-coordinates differ by 6; AC = 8 because the y-coordinates differ by 8; BC = sqrt(6 squared + 8 squared) = 10.

Ratio table for 1: sin B = AC/BC = 8/10 = 4/5. cos B = AB/BC = 6/10 = 3/5. sin C = AB/BC = 6/10 = 3/5. cos C = AC/BC = 8/10 = 4/5.

2. Sample response: “For angle B, AC is opposite, so sin B = AC/BC. For angle C, AC is adjacent, so cos C = AC/BC. Both ratios are 8/10.” Award credit when the student identifies the shared side and hypotenuse correctly.

Part 2 table: sin Q = PR/QR = 12/15 = 4/5. cos R = PR/QR = 12/15 = 4/5. cos Q = PQ/QR = 9/15 = 3/5. sin R = PQ/QR = 9/15 = 3/5.

3. sin Q = cos R; cos Q = sin R. **4.** Sample response: Both ratios have QR as denominator, but sin Q has opposite side PR as numerator while cos Q has adjacent side PQ as numerator. Since PR and PQ have different lengths, the ratios are not equal.

Source credit: New York Next Generation Mathematics, GEO-G.SRT.7, “Explain and use the relationship between the sine and cosine of complementary angles.” https://lessonmakerpro.com/standards/ny-nextgen-math/geo-g-srt-7. Diagrams and problems are original instructional content.