# Check Your Understanding 7.7

Name: _____ Period: _____ Date: _____

*Show all work. Estimate from the class trig table before using a calculator.*

| Basic | Intermediate | Advanced |
|---|---|---|
| **Row 3 Spiral — Solving for Missing Angles**<br>→ *Inverting the function* | | |
| *Basic — Spiral*<br>*1. A right triangle has sides 8, 15, 17. Find all three angles to the nearest degree.* | *Intermediate — Spiral*<br>*2. From a point 60 m from the base of a wall: angle of elevation to wall top is 37°, to a flagpole on the wall is 42°. Find the wall height and flagpole height.* | *Advanced — Spiral*<br>3. A plane flies from A at bearing 040° for 150 km to B, then bearing 130° for 200 km to C. Find distance A to C. *Bearings are measured clockwise from north. So a bearing of 040° means 40° east of north.* Then students can figure out the 90° angle themselves |
| **Row 4 Spiral — Special Right Triangles**<br>→ *Exact values worth deriving* | | |
| *Basic — Spiral*<br>4. Find exact values.<br>*(a) cos 30° + sin 60°*<br>*(b) sin²45° + cos²45°*<br>*(c) tan 45° + tan 30°* | *Intermediate — Spiral*<br>*5. A right triangle has a 30° angle. The side opposite the 60° angle is 9. Find all sides exactly and compute the area.* | *Advanced — Spiral*<br>*6. Without a calculator, find sin(2 × 30°) and compare to 2·sin30°. Are they equal? Use exact values.* |
| **Row 5 Spiral — Estimation**<br>→ *Trig as a function* | | |
| *Basic — Spiral*<br>*7. Order from least to greatest without a calculator: cos 20°, cos 50°, sin 20°, sin 50°. Justify.* | *Intermediate — Spiral*<br>*8. A student calculates sin(85°) ≈ 0.55. Explain why this cannot be correct using how sine behaves approaching 90°.* | *Advanced — Spiral*<br>*9. Without a calculator, estimate sin(75°) to one decimal place. Use the graphs of sine and cosine and your exact benchmarks.* |

| Basic | Intermediate | Advanced |
|---|---|---|
| **Trig Beyond Right Triangles — Law of Cosines**<br>*→ Extending invariants* | | |
| *Basic*<br>*10. In △ABC: a = 7, b = 9, C = 48°. Find side c.*<br><br>*11. In △PQR: p = 10, q = 6, r = 8. Find angle Q.*<br><br>*12. A triangle has sides 5, 5, 5. Use the Law of Cosines to show all angles are 60°.* | *Intermediate*<br>13. For each, state Law of Sines or Law of Cosines and explain in one sentence.<br><br>*(a) SAS — two sides and included angle.*<br><br>*(b) AAS — two angles and one side.*<br><br>*(c) SSS — find an angle.*<br><br>*14. Two ships leave port. A: 22 km/h at bearing 035°. B: 17 km/h at bearing 112°. Distance apart after 2 hours?* | *Advanced*<br>15. Derive the Law of Cosines using the altitude method. Show $c^2 = a^2 + b^2 - 2ab\cdot\cos C$. Explain every step.<br><br>16. When C = 90°, the Law of Cosines becomes $c^2 = a^2 + b^2$. Explain why and what this says about the relationship between the two laws. |
| **Algebra Spiral**<br>*Simplify* | *Algebra Spiral*<br>Simplify each expression completely.<br><br>*(a) $6x^2 - 3x - 2x^2 + 8x - x$*<br><br>*(b) $4(3a + 2) - 2(5a - 7)$*<br><br>*(c) $(9y^3 - y + 4) - (4y^3 + 2y - 1)$* | |

# Answers — CYU 7.7

## Row 3 Spiral

**1.** $\sin^{-1}(8/17) \approx 28°$. Other = 62°. Right angle = 90°.

**2.** Wall = $60\tan37° \approx 45.2$ m. Top of flagpole = $60\tan42° \approx 54.0$ m. Flagpole ≈ 8.8 m.

**3.** From A: N = $150\cos40° \approx 114.9$, E = $150\sin40° \approx 96.4$. From B: N = $-200\cos50° \approx -128.6$, E = $200\sin50° \approx 153.2$. C from A: N ≈ −13.7, E ≈ 249.6. AC ≈ 250 km.

## Row 4 Spiral

**4a.** $\sqrt{3}$

**4b.** 1

**4c.** $(3+\sqrt{3})/3$

**5.** Short leg = $3\sqrt{3}$, hyp = $6\sqrt{3}$. Area = $\frac{1}{2}(3\sqrt{3})(9) = 27\sqrt{3}/2$.

**6.** $\sin60° = \sqrt{3}/2 \approx 0.866$. $2\cdot\sin30° = 1$. Not equal.

## Row 5 Spiral

**7.** $\sin20° \approx 0.342 < \cos50° = \sin40° \approx 0.643 < \sin50° \approx 0.766 < \cos20° \approx 0.940$.

**8.** $\sin90° = 1$. $\sin85°$ must be very close to 1. 0.55 corresponds to ~33°.

**9.** $\sin60° \approx 0.866$, $\sin90° = 1$. 75° is ¾ of the way from 60° to 90°. Estimate ~0.96. Actual: 0.966.

## Law of Cosines

**10.** $c^2 = 49+81-126\cos48° \approx 45.7$. $c \approx 6.76$.

**11.** $\cos Q = (100+64-36)/160 = 0.8$. $Q \approx 36.9°$.

**12.** $\cos A = (25+25-25)/50 = 0.5$. $A = 60°$. Symmetry: all angles 60°.

**13a.** Law of Cosines — no angle-opposite-side pair available.

**13b.** Law of Sines — two angles give the third, creating an angle-side pair.

**13c.** Law of Cosines rearranged.

**14.** After 2 h: A = 44 km at 035°, B = 34 km at 112°. Angle between = 77°. $c^2 = 44^2+34^2-2(44)(34)\cos77° \approx 2419$. $c \approx 49.2$ km.

**15.** Drop altitude h from C. BH = x, HA = c−x. $h^2+x^2 = a^2$, $h^2+(c-x)^2 = b^2$. Subtract: $c^2-2cx = b^2-a^2$. $x = a\cdot\cos B$ → $b^2 = a^2+c^2-2ac\cdot\cos B$. Rename → $c^2 = a^2+b^2-2ab\cdot\cos C$. ■

**16.** $\cos90° = 0$, so $c^2 = a^2+b^2$. Pythagorean theorem is the special case of Law of Cosines when C = 90°.

## Algebra Spiral

**(a)** $4x^2 + 4x$

**(b)** $2a + 22$

**(c)** $5y^3 - 3y + 5$