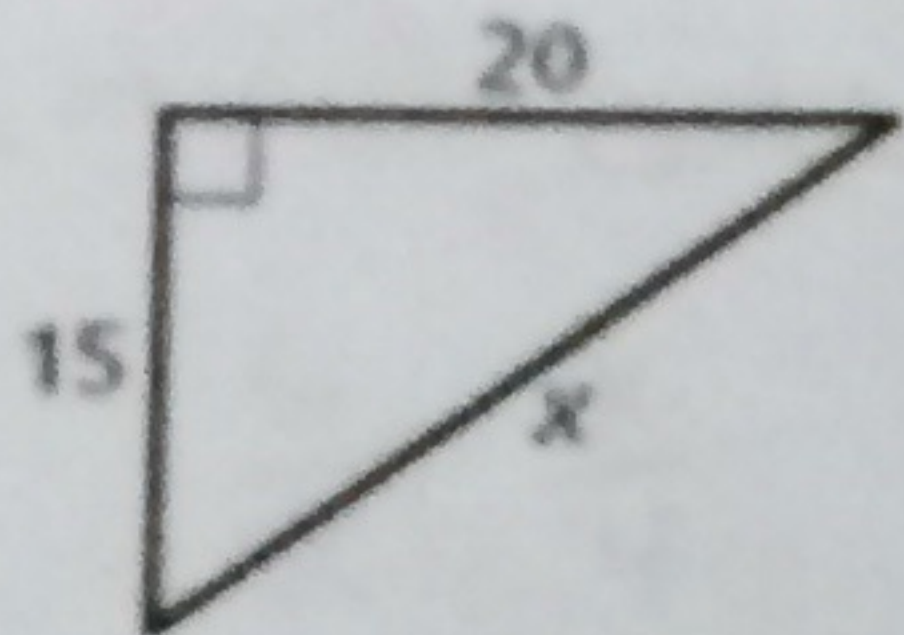


Unit 7: Right Triangles and Trigonometry Practice Problems

7.1 The Pythagorean Theorem

Find the value of x . Then tell whether the side lengths form a Pythagorean triple.

1.



$$15^2 + 20^2 = x^2$$

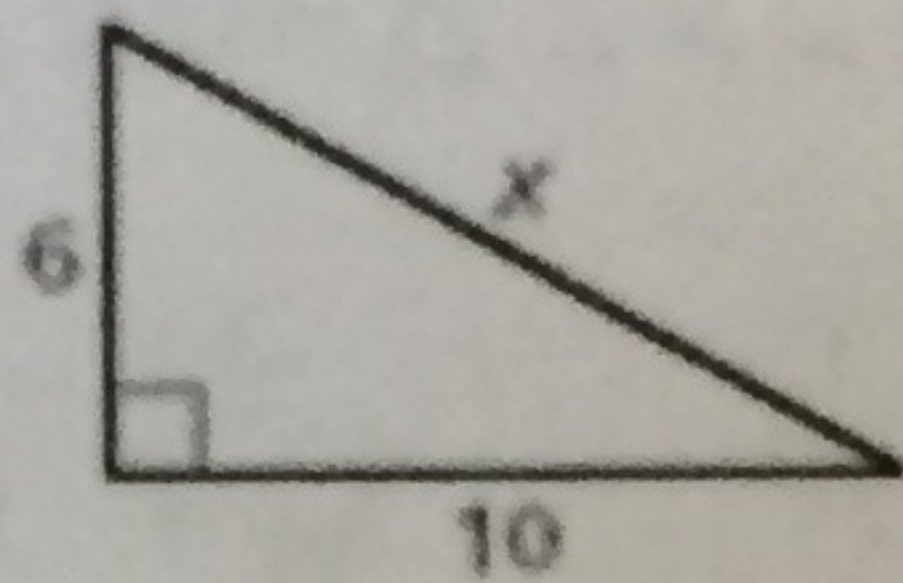
$$225 + 400 = x^2$$

$$625 = x^2$$

$$\boxed{25 = x}$$

Pythagorean triple

2.



$$6^2 + 10^2 = x^2$$

$$36 + 100 = x^2$$

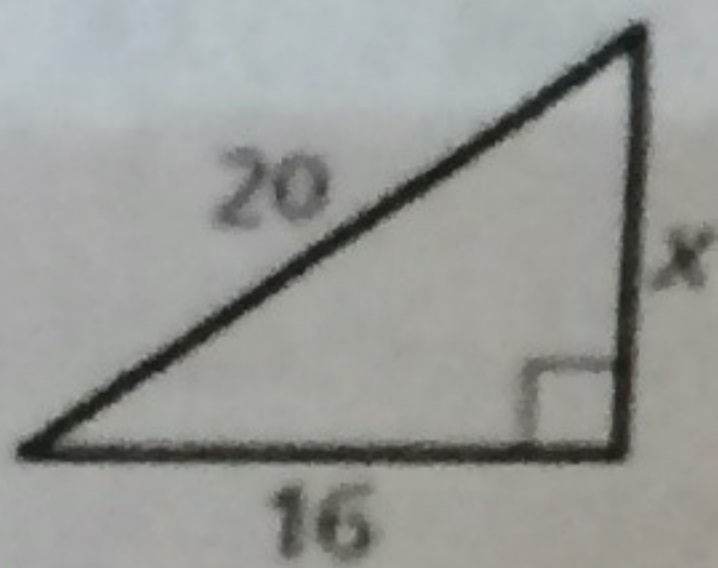
$$136 = x^2$$

$$\sqrt{136} = x$$

$$\boxed{2\sqrt{34} = x}$$

not a Pythagorean triple

3.



$$x^2 + 16^2 = 20^2$$

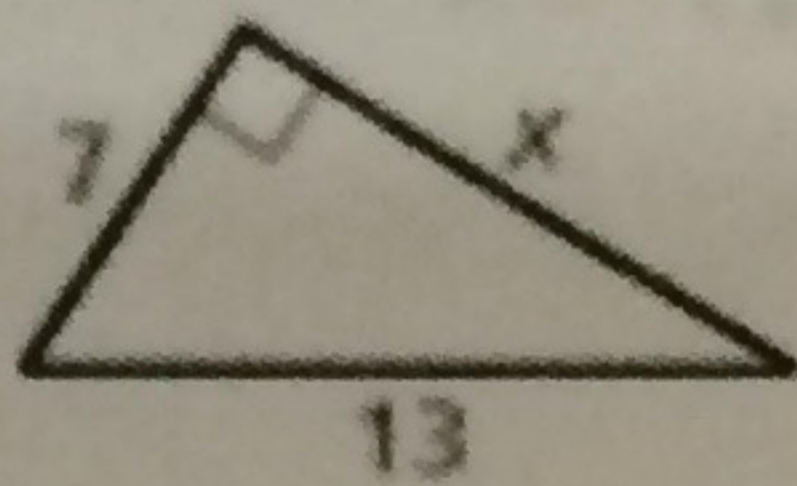
$$x^2 + 256 = 400$$

$$x^2 = 144$$

$$\boxed{x = 12}$$

Pythagorean triple

4.



$$x^2 + 7^2 = 13^2$$

not a Pythagorean triple

$$x^2 + 49 = 169$$

$$x^2 = 120$$

$$x = \sqrt{120}$$

$$\boxed{x = 2\sqrt{30}}$$

Verify that the segment lengths form a triangle. Is the triangle *acute*, *right*, or *obtuse*?

5. 6, 8, 9

$$9^2 \square 6^2 + 8^2$$

$$6 + 8 > 9$$

$$14 > 9$$

$$81 \square 36 + 64$$

$$6 + 9 > 8$$

$$15 > 8$$

$$81 \square 100$$

$$8 + 9 > 6$$

$$81 < 100$$

$$17 > 6$$

$\boxed{\text{acute}}$

6. 10, $2\sqrt{2}$, $6\sqrt{3}$

$$(6\sqrt{3})^2 \square 10^2 + (2\sqrt{2})^2$$

$$10 + 2\sqrt{3} > 6\sqrt{3}$$

$$2\sqrt{2} + 6\sqrt{3} > 10$$

$$108 \square 100 + 8$$

$$10 + 6\sqrt{3} > 2\sqrt{2}$$

$$108 \square 108$$

$$108 = 108$$

$\boxed{\text{right}}$

7. 13, 18, $3\sqrt{55}$

$$(3\sqrt{55})^2 \square 13^2 + 18^2$$

$$13 + 18 > 3\sqrt{55}$$

$$13 + 3\sqrt{55} > 18$$

$$18 + 3\sqrt{55} > 13$$

$$495 \square 169 + 324$$

$$495 \square 493$$

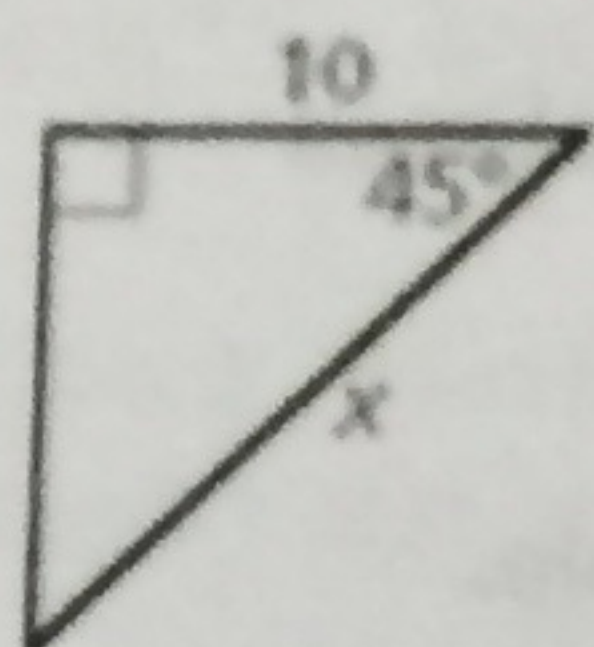
$$495 > 493$$

$\boxed{\text{obtuse}}$

7.2 Special Right Triangles

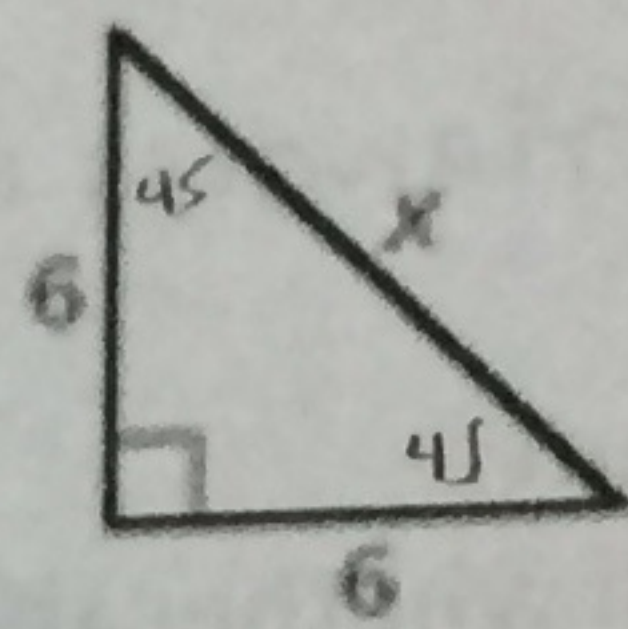
Find the value of x . Write your answer in simplest radical form.

8.



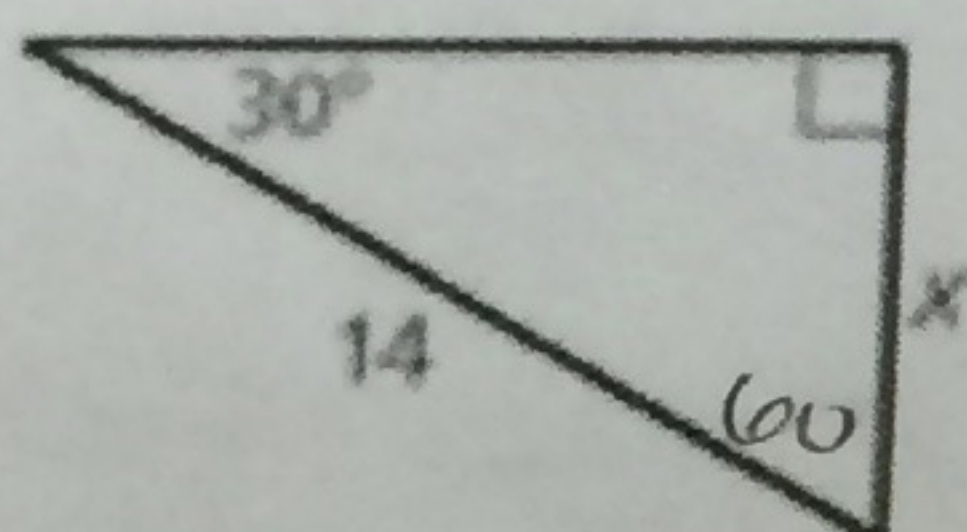
$$\begin{aligned} \text{hyp} &= \sqrt{2} \cdot \text{leg} \\ x &= \sqrt{2} \cdot 10 \\ \boxed{x} &= 10\sqrt{2} \end{aligned}$$

9.



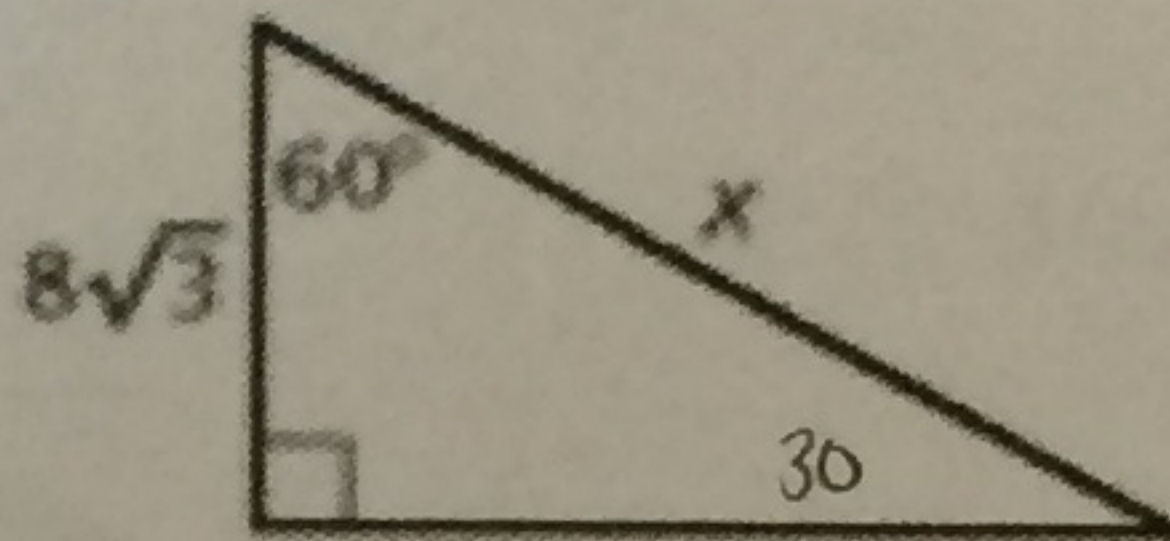
$$\begin{aligned} \text{hyp} &= \sqrt{2} \cdot \text{leg} \\ x &= \sqrt{2} \cdot 6 \\ \boxed{x} &= 6\sqrt{2} \end{aligned}$$

10.



$$\begin{aligned} \text{hyp} &= 2 \cdot \text{sl} & \text{ll} &= \sqrt{3} \cdot \text{sl} \\ 14 &= 2 \cdot x \\ \boxed{7} &= x \end{aligned}$$

11.

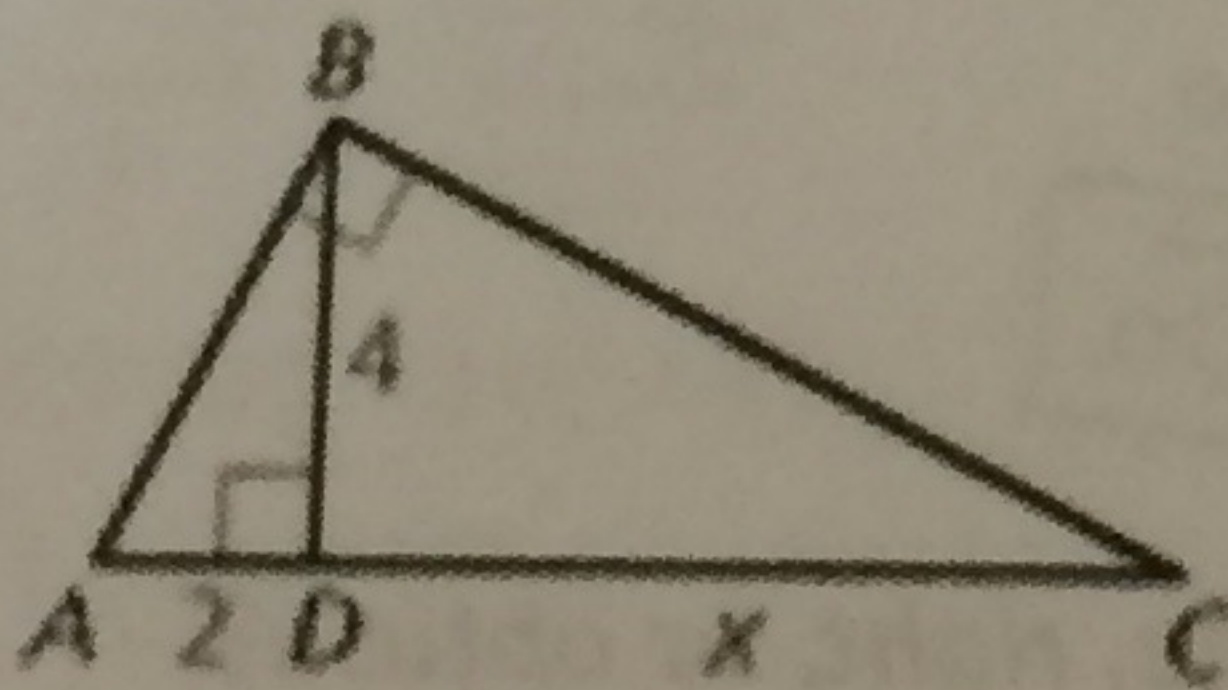


$$\begin{aligned} \text{hyp} &= 2 \cdot \text{sl} & \text{ll} &= \sqrt{3} \cdot \text{sl} \\ x &= 2 \cdot 8\sqrt{3} \\ \boxed{x} &= 16\sqrt{3} \end{aligned}$$

7.3 Similar Right Triangles

Identify the similar triangles. Then find the value of x .

12.



$$\triangle BAC \sim \triangle DAB \sim \triangle DBC$$

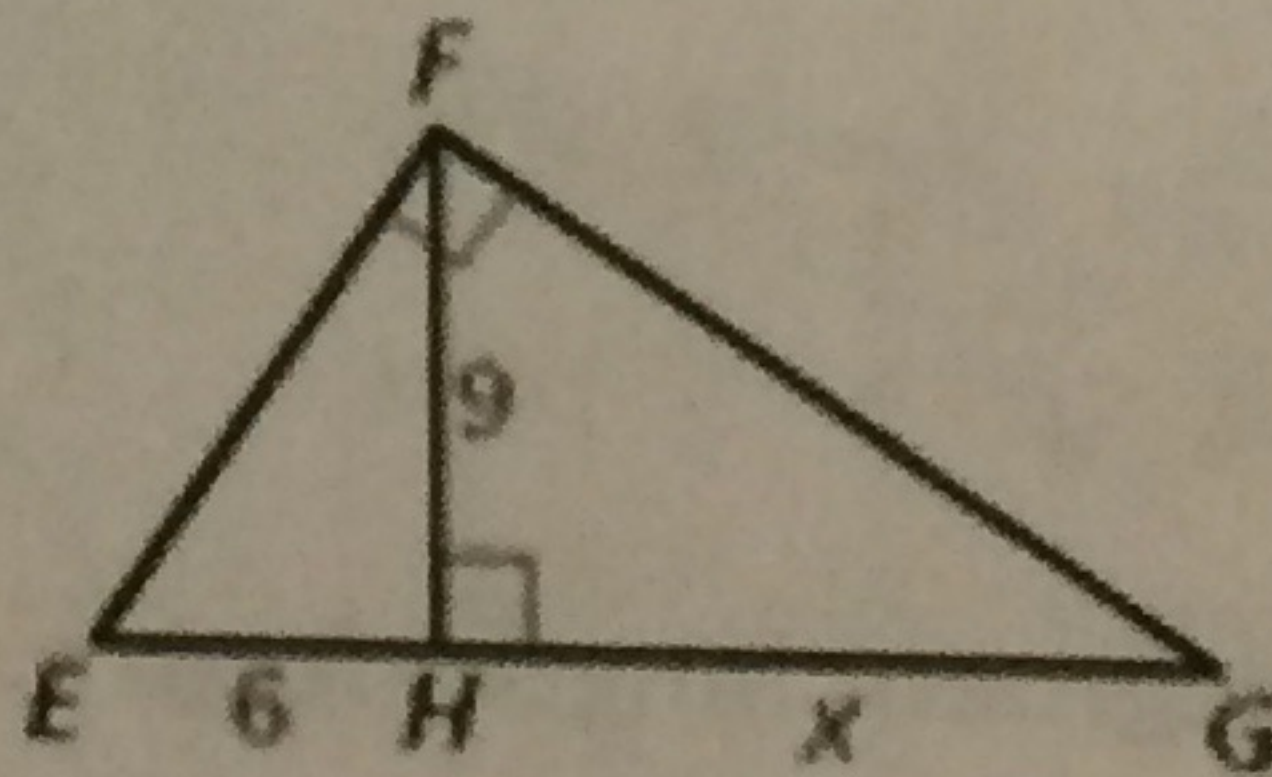
$$\frac{\text{sl}}{\text{ll}} = \frac{\text{sl}}{\text{ll}}$$

$$\frac{2}{4} = \frac{4}{x}$$

$$2x = 16$$

$$\boxed{x} = 8$$

13.



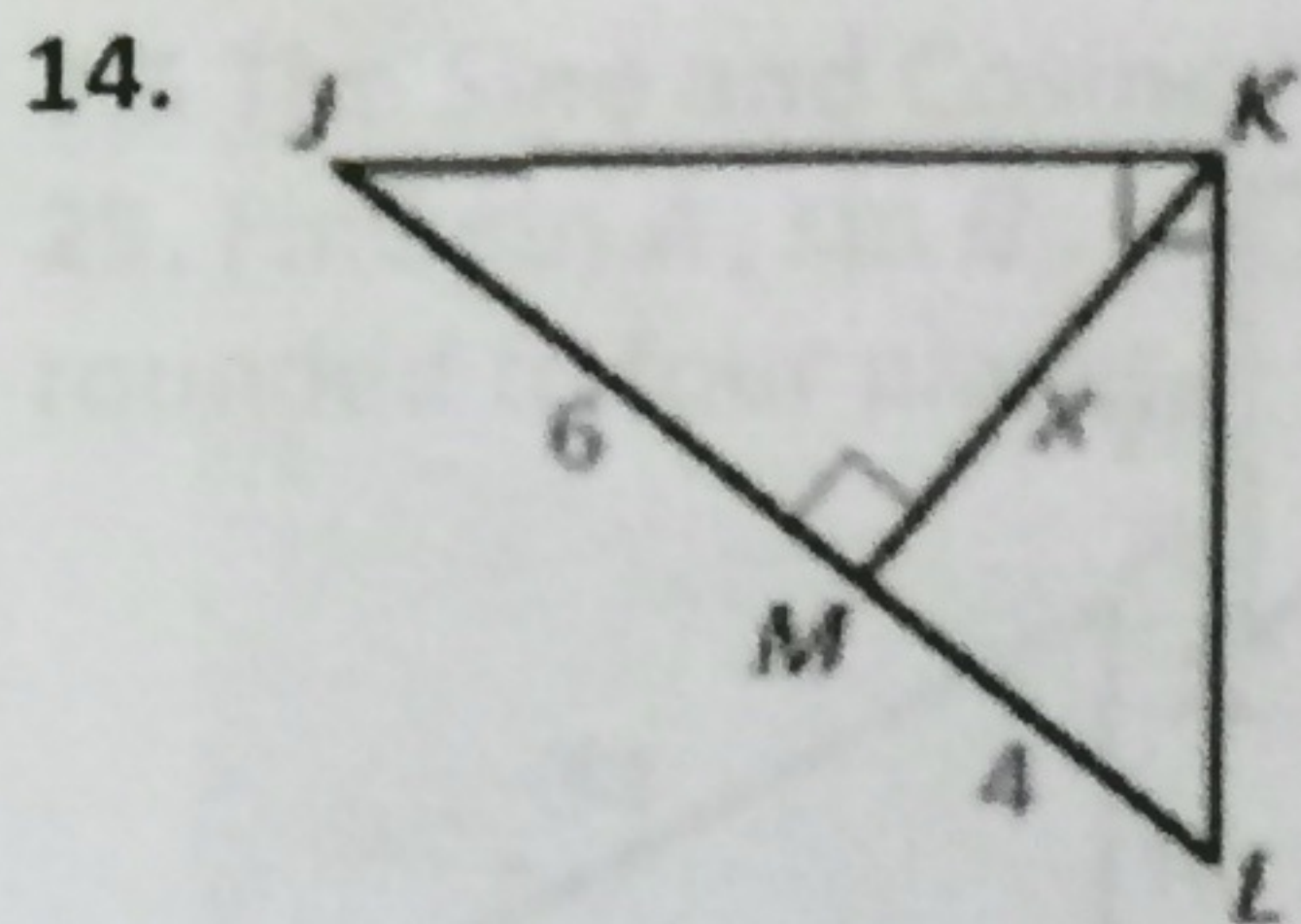
$$\triangle FEG \sim \triangle HEF \sim \triangle HFG$$

$$\frac{\text{sl}}{\text{ll}} = \frac{\text{sl}}{\text{ll}}$$

$$\frac{6}{9} = \frac{9}{x}$$

$$6x = 81$$

$$\boxed{x} = 13.5$$

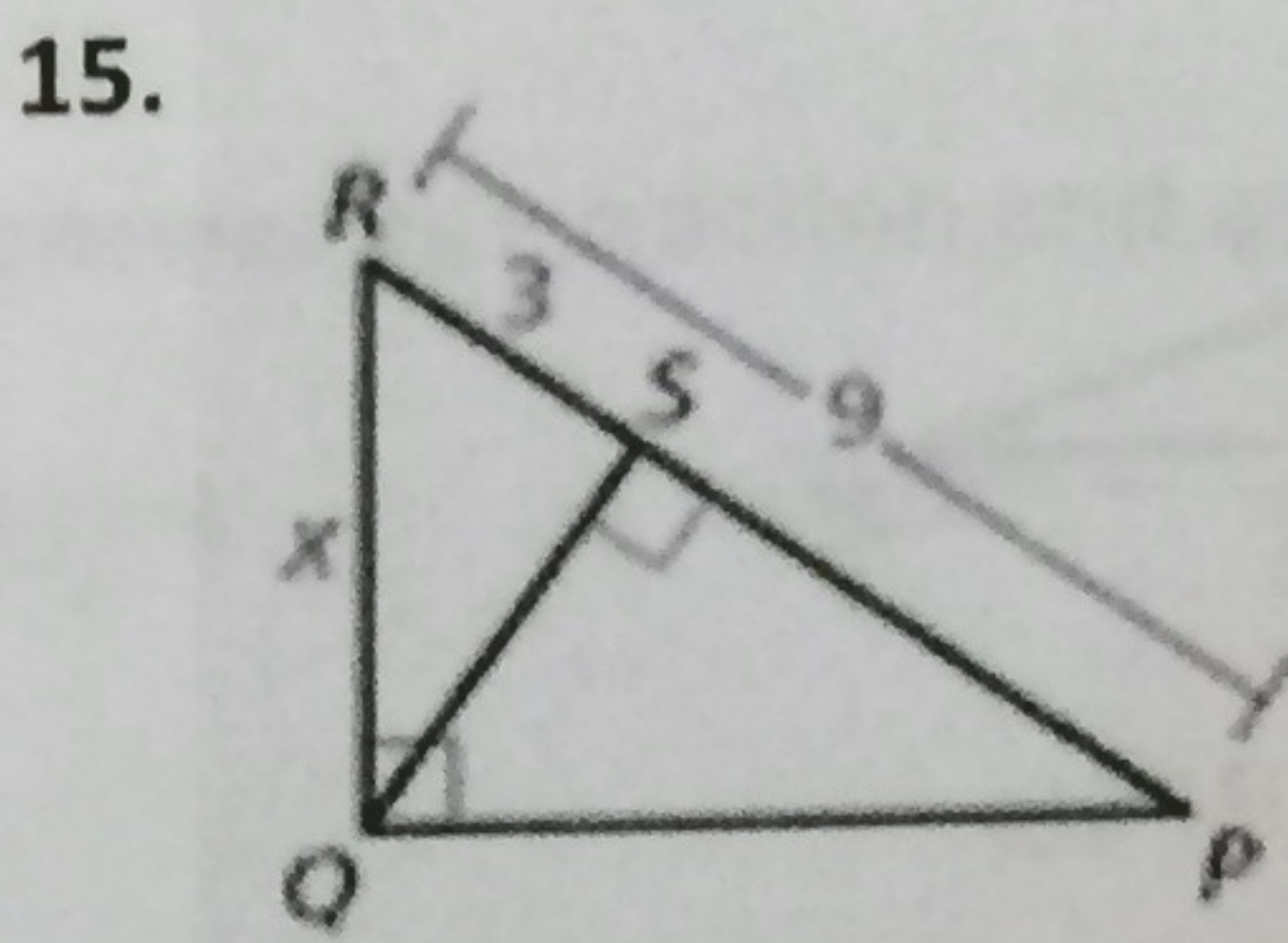


$$\triangle K LJ \sim \triangle M K J \sim \triangle M L K$$

$$\frac{ll}{sl} = \frac{ll}{sl} \quad \frac{6}{x} = \frac{x}{4} \quad \boxed{x = 2\sqrt{6}}$$

$$x^2 = 24$$

$$x = \sqrt{24} = 2\sqrt{6}$$



$$\triangle Q R P \sim \triangle S R Q \sim \triangle S Q P$$

$$\frac{sl}{hyp} = \frac{sl}{hyp}$$

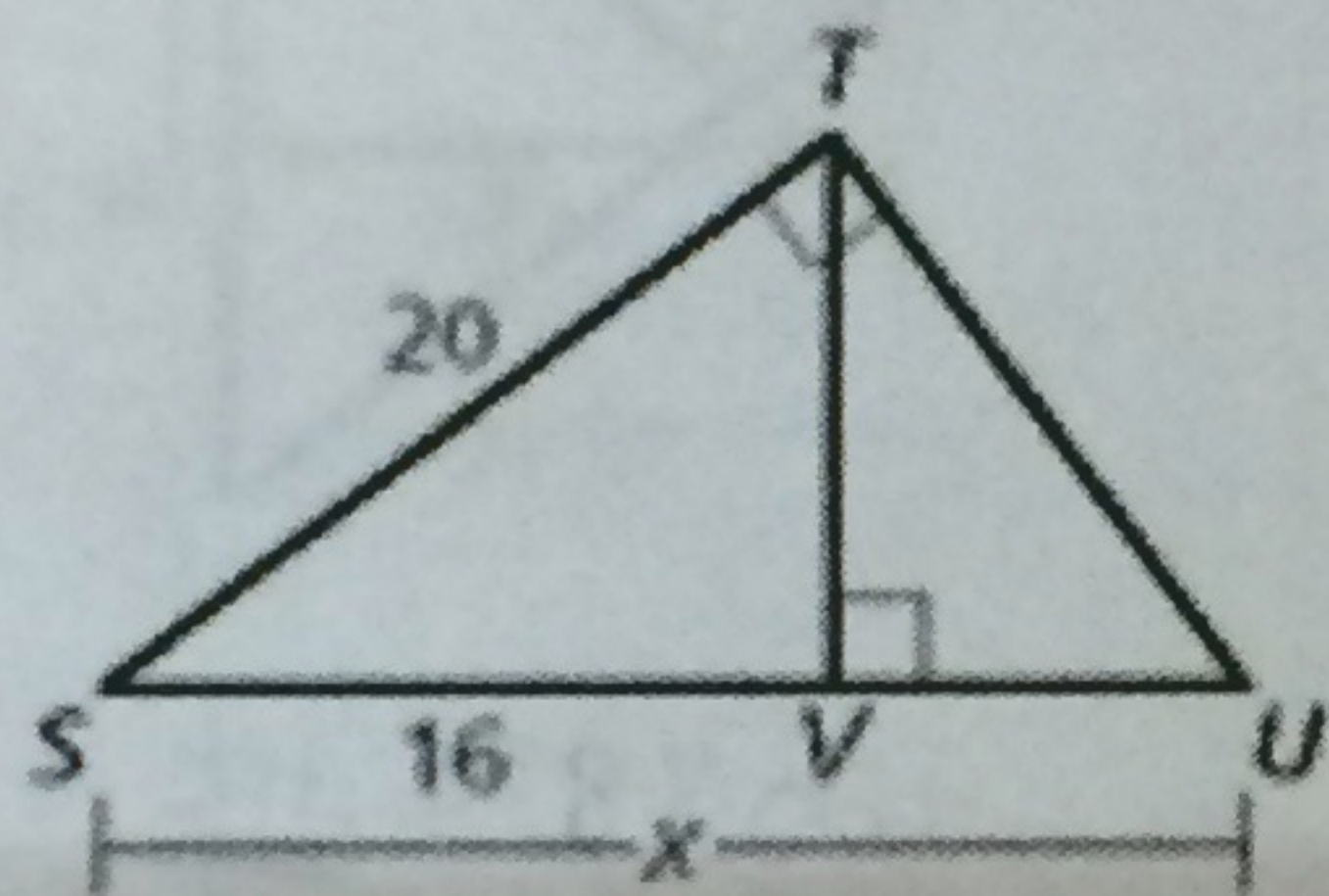
$$\frac{x}{9} = \frac{3}{x}$$

$$x^2 = 27$$

$$x = \sqrt{27}$$

$$\boxed{x = 3\sqrt{3}}$$

16.



$$\triangle T U S \sim \triangle V U T \sim \triangle V T S$$

$$\frac{ll}{hyp} = \frac{ll}{hyp}$$

$$\frac{20}{x} = \frac{16}{20}$$

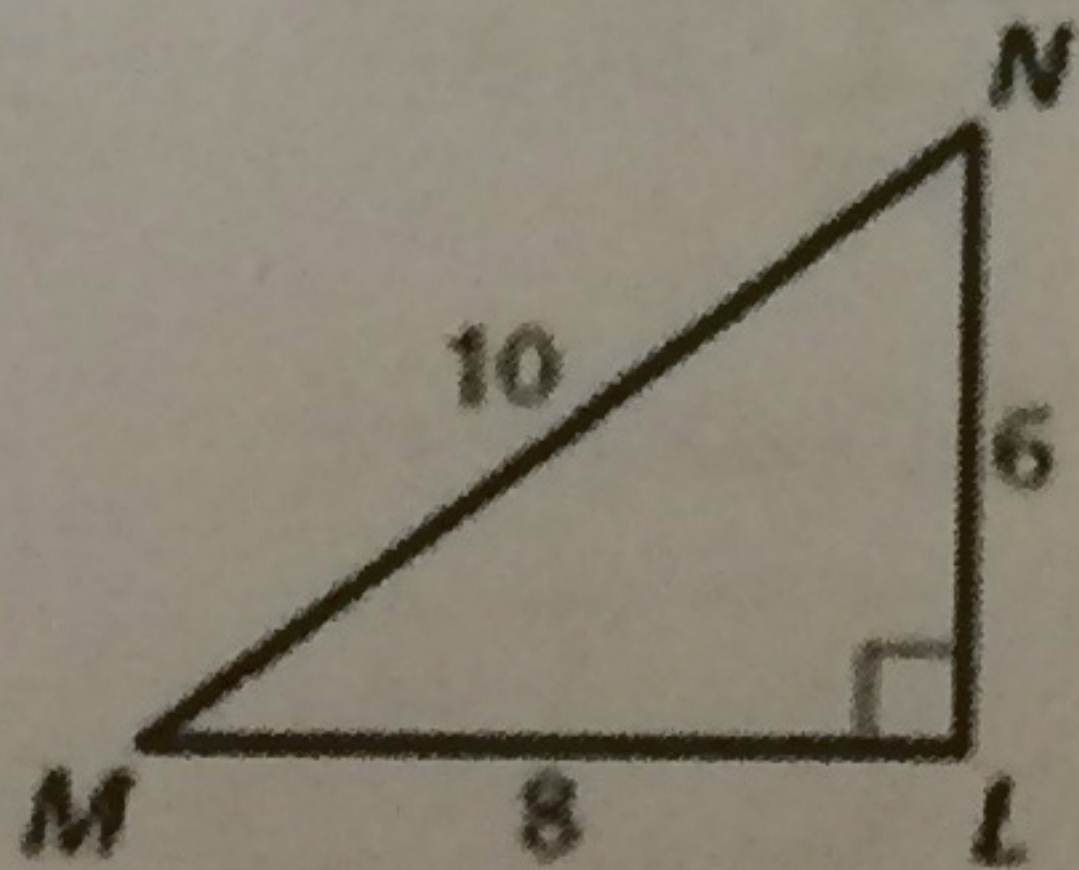
$$\boxed{x = 25}$$

$$16x = 400$$

7.4 The Tangent Ratio

Find the tangents of the acute angles in the right triangle. Write each answer as a fraction and as a decimal rounded to four decimal places.

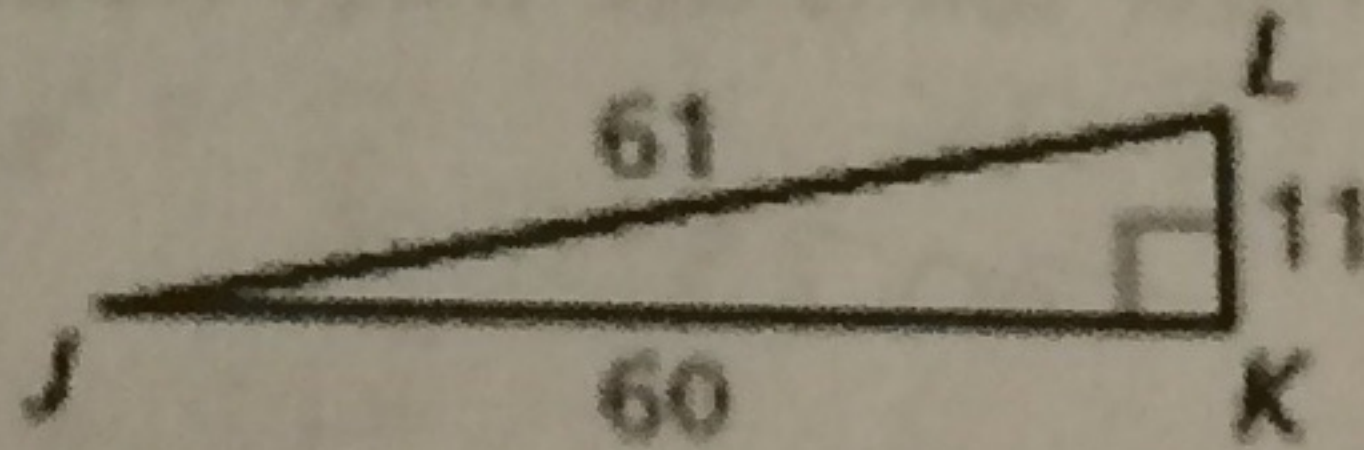
17.



$$\tan M = \frac{6}{8} = .75$$

$$\tan N = \frac{8}{6} = 1.3333$$

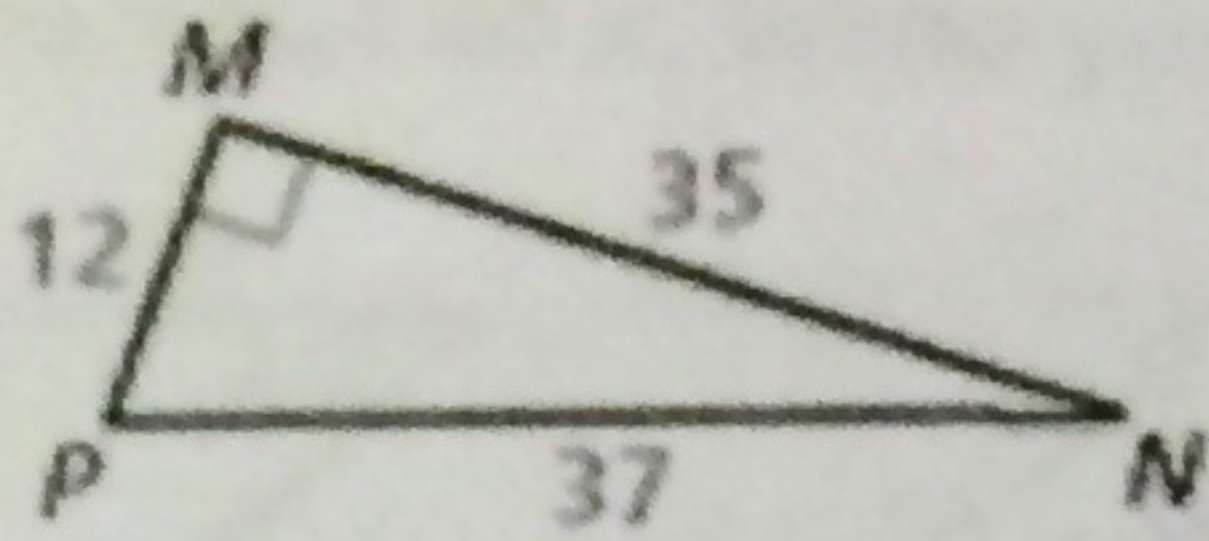
18.



$$\tan J = \frac{11}{60} = .1833$$

$$\tan L = \frac{60}{11} = 5.4545$$

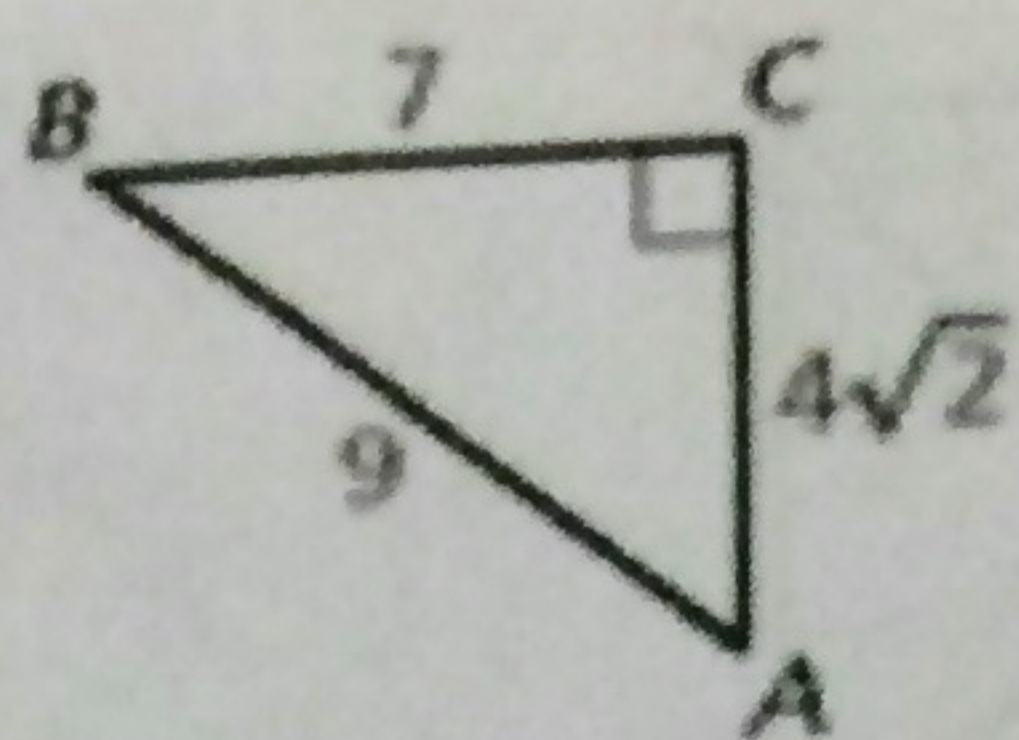
19.



$$\tan P = \frac{35}{12} = 2.9166$$

$$\tan N = \frac{12}{35} = 0.3429$$

20.

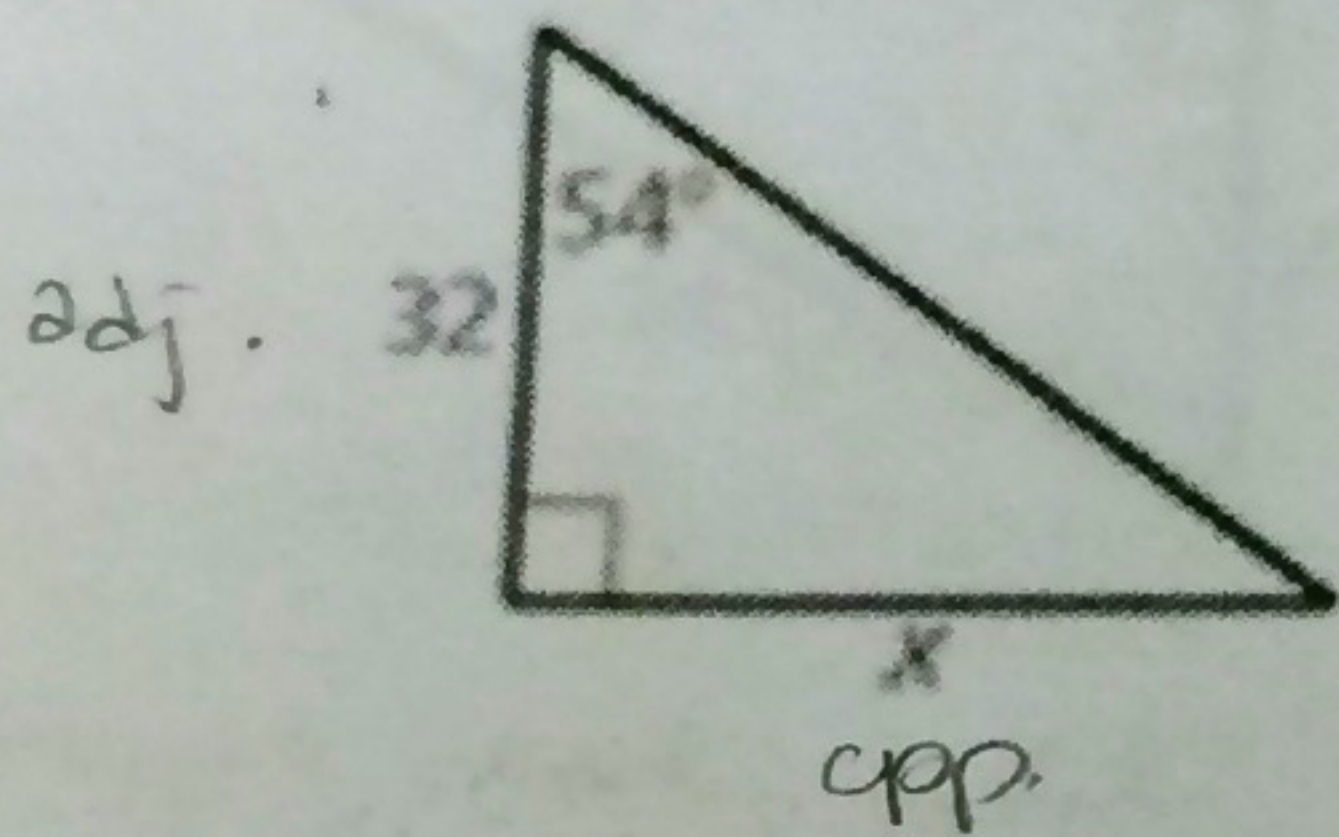


$$\tan A = \frac{7}{4\sqrt{2}} = 1.2374$$

$$\tan B = \frac{4\sqrt{2}}{7} = 0.8081$$

Find the value of x . Round your answer to the nearest tenth.

21.

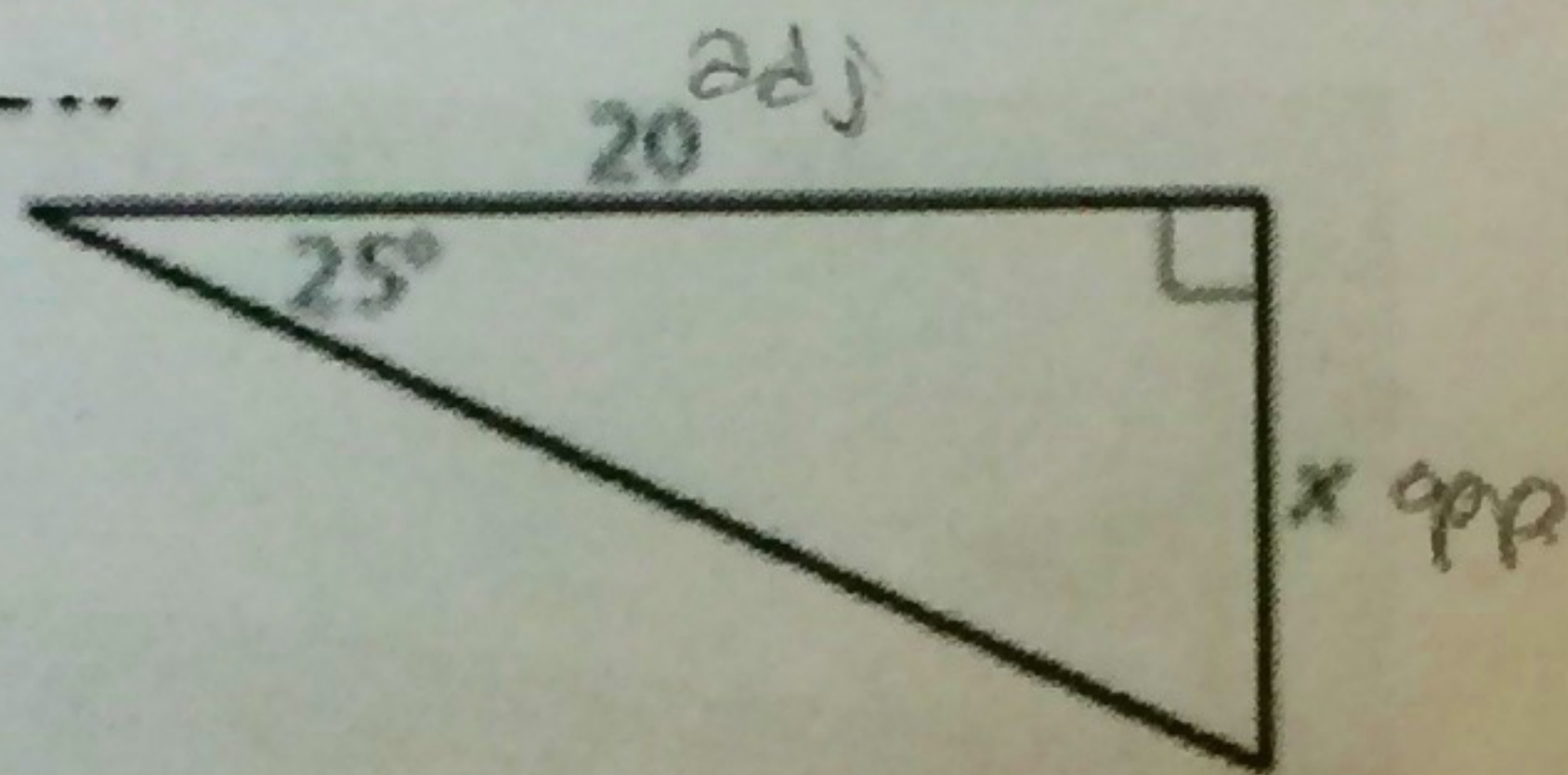


$$\tan 54^\circ = \frac{x}{32}$$

$$x = 32 \tan 54^\circ$$

$$x \approx 44.0$$

22.

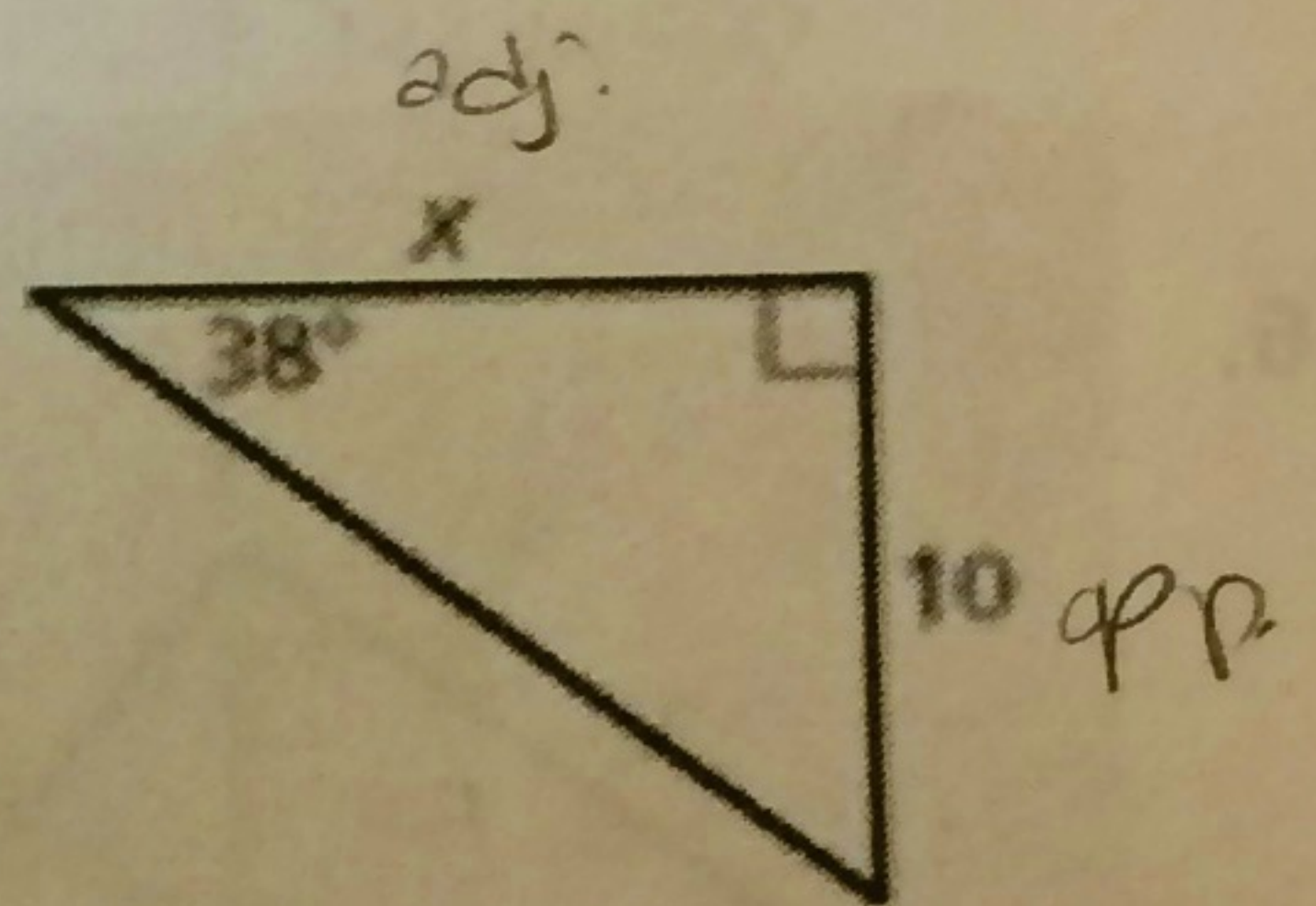


$$\tan 25^\circ = \frac{x}{20}$$

$$x = 20 \tan 25^\circ$$

$$x \approx 9.3$$

23.



$$\tan 38^\circ = \frac{10}{x}$$

$$x = \frac{10}{\tan 38^\circ}$$

$$x \approx 12.8$$

24. The angle between the bottom of a fence and the top of a tree is 75° . The tree is 4 feet from the fence. How tall is the tree? Round your answer to the nearest foot.



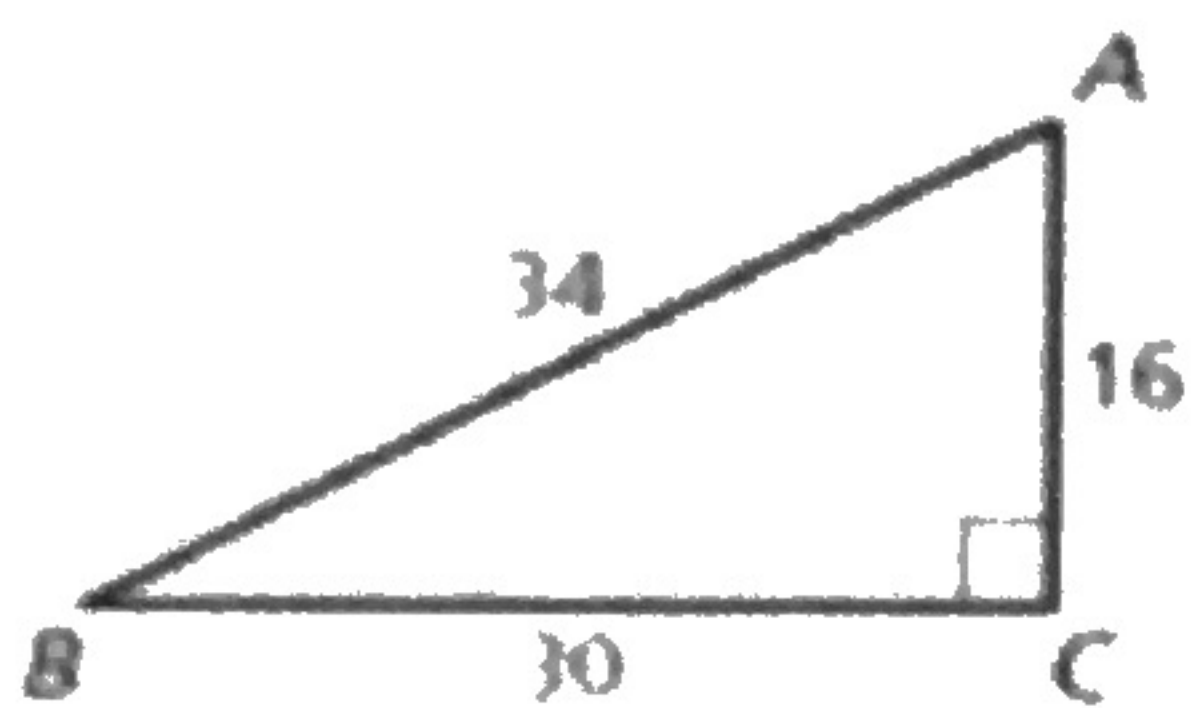
$$\tan 75^\circ = \frac{x}{4}$$

$$x = 4 \tan 75^\circ$$

$$x \approx 15 \text{ ft}$$

7.5 The Sine and Cosine Ratios

25. Find $\sin A$, $\sin B$, $\cos A$, and $\cos B$. Write each answer as a fraction and as a decimal rounded to four places.



$$\sin A = \frac{30}{34} = 0.8824$$

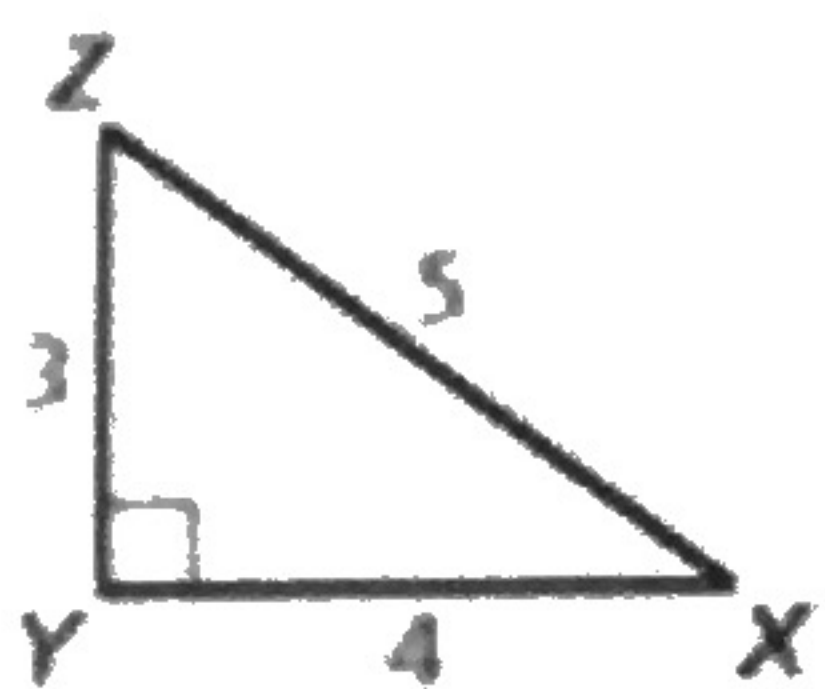
$$\cos A = \frac{16}{34} = 0.4706$$

$$\sin B = \frac{16}{34} = 0.4706$$

$$\cos B = \frac{30}{34} = 0.8824$$

Find $\sin X$, $\sin Z$, $\cos X$, and $\cos Z$. Write each answer as a fraction and as a decimal rounded to four decimal places.

26.



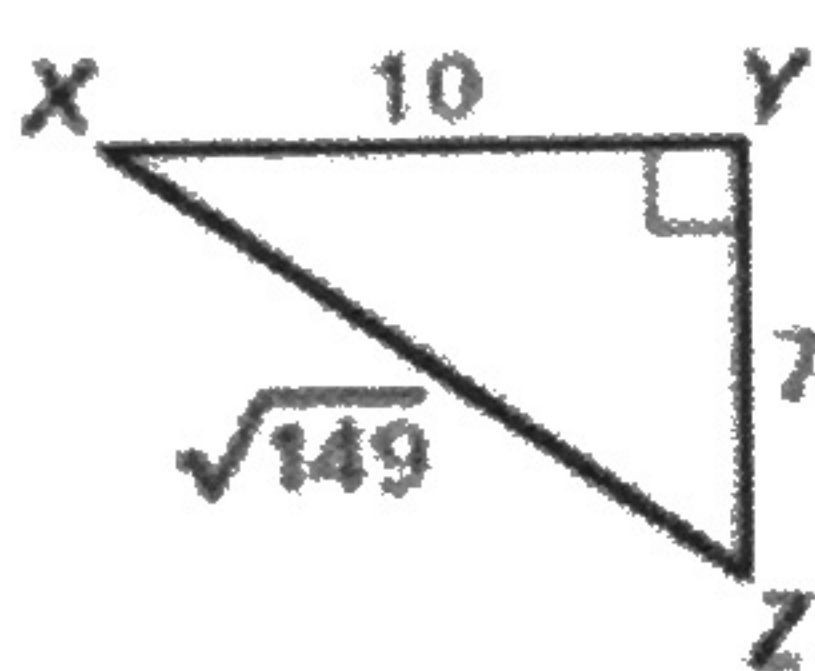
$$\sin X = \frac{3}{5} = 0.6$$

$$\cos Z = \frac{4}{5} = 0.8$$

$$\cos X = \frac{4}{5} = 0.8$$

$$\cos Z = \frac{3}{5} = 0.6$$

27.



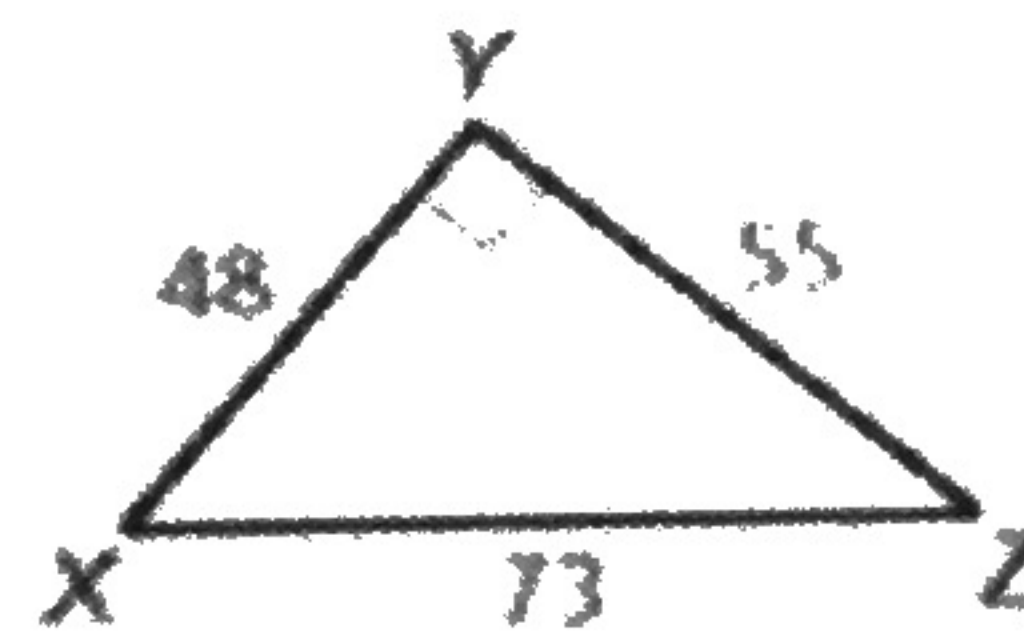
$$\sin X = \frac{7}{\sqrt{149}} = 0.5612$$

$$\sin Z = \frac{10}{\sqrt{149}} = 0.8192$$

$$\cos X = \frac{10}{\sqrt{149}} = 0.8192$$

$$\cos Z = \frac{7}{\sqrt{149}} = 0.5612$$

28.



$$\sin X = \frac{55}{73} = 0.7534$$

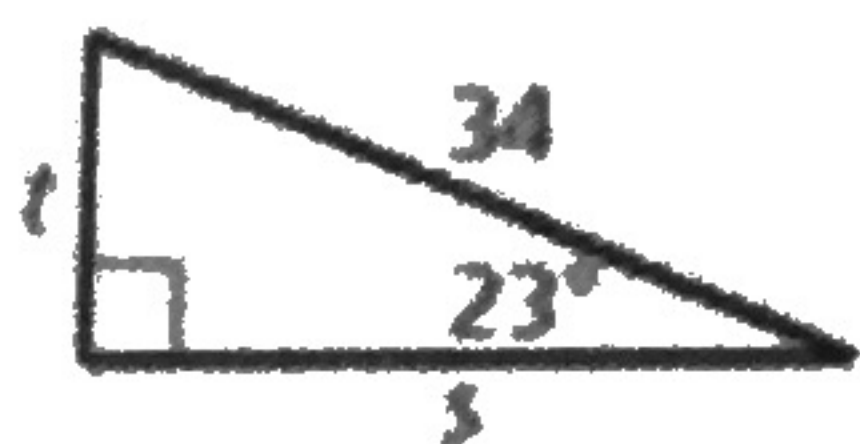
$$\sin Z = \frac{48}{73} = 0.6575$$

$$\cos X = \frac{48}{73} = 0.6575$$

$$\cos Z = \frac{55}{73} = 0.7534$$

Find the value of each variable using sine and cosine. Round your answers to the nearest tenth.

29.



$$\sin 23^\circ = \frac{t}{34}$$

$$\cos 23^\circ = \frac{s}{34}$$

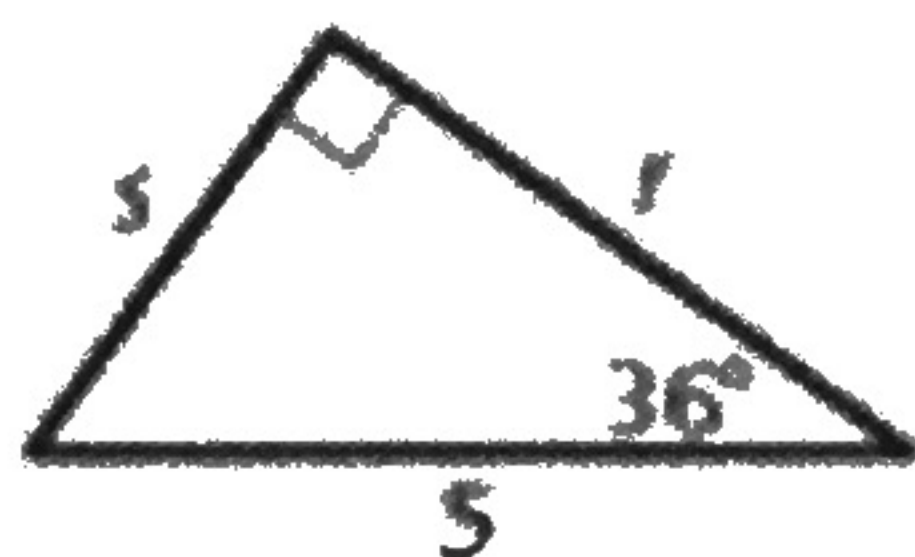
$$t = 34 \sin 23^\circ$$

$$s = 34 \cos 23^\circ$$

$$t \approx 13.3$$

$$s \approx 31.3$$

30.



$$\sin 36^\circ = \frac{s}{5}$$

$$\cos 36^\circ = \frac{r}{5}$$

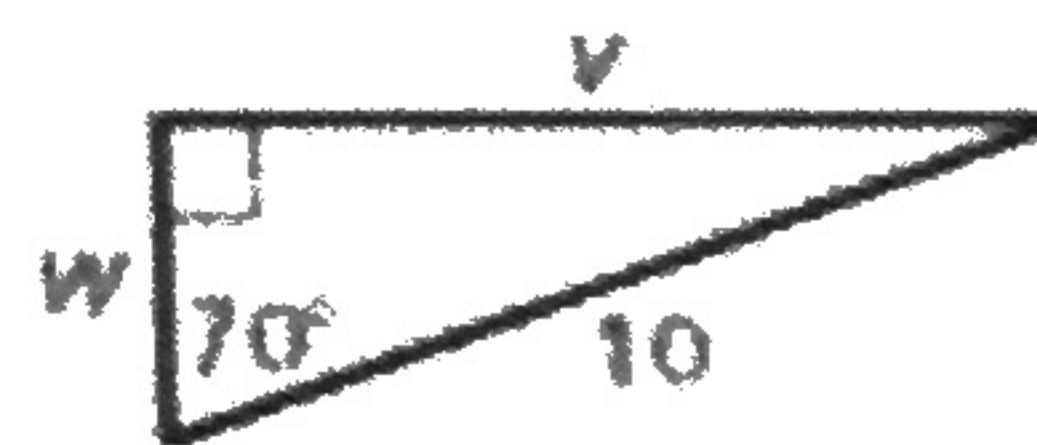
$$s = 5 \sin 36^\circ$$

$$r = 5 \cos 36^\circ$$

$$s \approx 2.9$$

$$r \approx 4.0$$

31.



$$\sin 70^\circ = \frac{v}{10}$$

$$\cos 70^\circ = \frac{w}{10}$$

$$v = 10 \sin 70^\circ$$

$$w = 10 \cos 70^\circ$$

$$v \approx 9.4$$

$$w \approx 3.4$$

32. Write $\sin 72^\circ$ in terms of cosine.

$$\sin 72^\circ = \cos(90^\circ - 72^\circ) = \cos 18^\circ$$

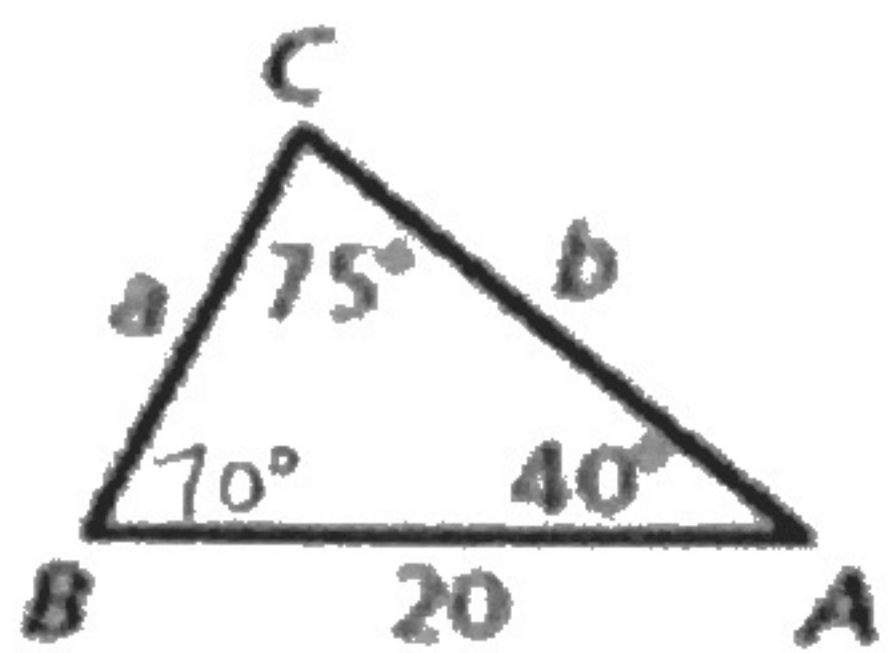
33. Write $\cos 29^\circ$ in terms of sine.

$$\cos 29^\circ = \sin(90^\circ - 29^\circ) = \sin 61^\circ$$

7.7 Law of Sines and Law of Cosines

Solve the triangle. Round decimal answers to the nearest tenth.

41.



$$a \sin 75^\circ = 20 \sin 40^\circ$$

$$a = \frac{20 \sin 40^\circ}{\sin 75^\circ}$$

$$a \approx 13.3$$

$$\frac{\sin 40^\circ}{a} = \frac{\sin 70^\circ}{b} = \frac{\sin 75^\circ}{20}$$

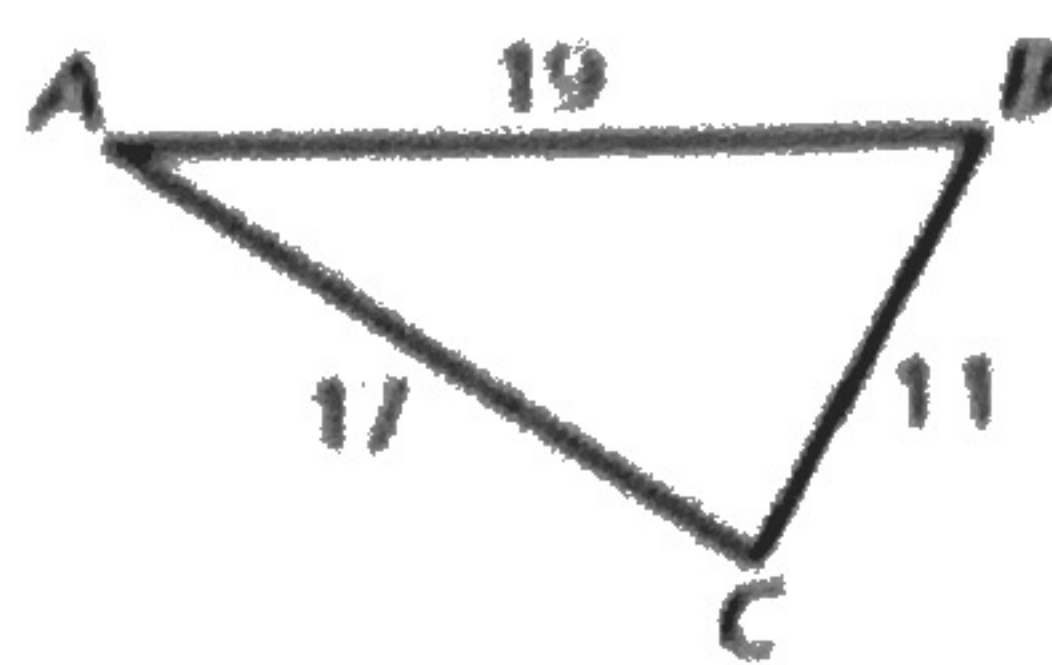
$$b \sin 75^\circ = 20 \sin 70^\circ$$

$$b = \frac{20 \sin 70^\circ}{\sin 75^\circ}$$

$$b \approx 19.5$$

$$m\angle B = 70^\circ$$

42.



$$m\angle C = 62.6^\circ$$

$$11^2 = 17^2 + 19^2 - 2(17)(19) \cos A \quad \frac{\sin 35^\circ}{11} = \frac{\sin B}{17}$$

$$121 = 650 - 646 \cos A$$

$$-529 = -646 \cos A$$

$$.8188... = \cos A$$

$$m\angle A = \cos^{-1}(.8188...)$$

$$m\angle A \approx 35.0^\circ$$

$$\sin B = \frac{17 \sin 35^\circ}{11}$$

$$m\angle B = \sin^{-1}\left(\frac{17 \sin 35^\circ}{11}\right)$$

$$m\angle B = 62.4^\circ$$

Find the area of $\triangle ABC$ with the given side lengths and included angle.

43. $m\angle B = 124^\circ, a = 9, c = 11$

$$\text{Area} = \frac{1}{2}(9)(11) \sin 124^\circ$$

$$A = 41.0$$

44. $m\angle A = 68^\circ, b = 13, c = 7$

$$\text{Area} = \frac{1}{2}(13)(7) \sin 68^\circ$$

$$A = 42.2$$

45. $m\angle C = 79^\circ, a = 25, b = 17$

$$A = \frac{1}{2}(25)(17) \sin 79^\circ$$

$$A = 208.6$$

Solve $\triangle ABC$. Round decimal answers to the nearest tenth.

46. $m\angle A = 112^\circ, a = 9, b = 4$



$$\frac{\sin 112}{9} = \frac{\sin B}{4} = \frac{\sin C}{c}$$

$$9 \sin B = 4 \sin 112$$

$$\sin B = \frac{4 \sin 112}{9}$$

$$\frac{\sin 112}{9} = \frac{\sin 43.7}{c}$$

$$c \sin 112 = 9 \sin 43.7$$

$$c = \frac{9 \sin 43.7}{\sin 112}$$

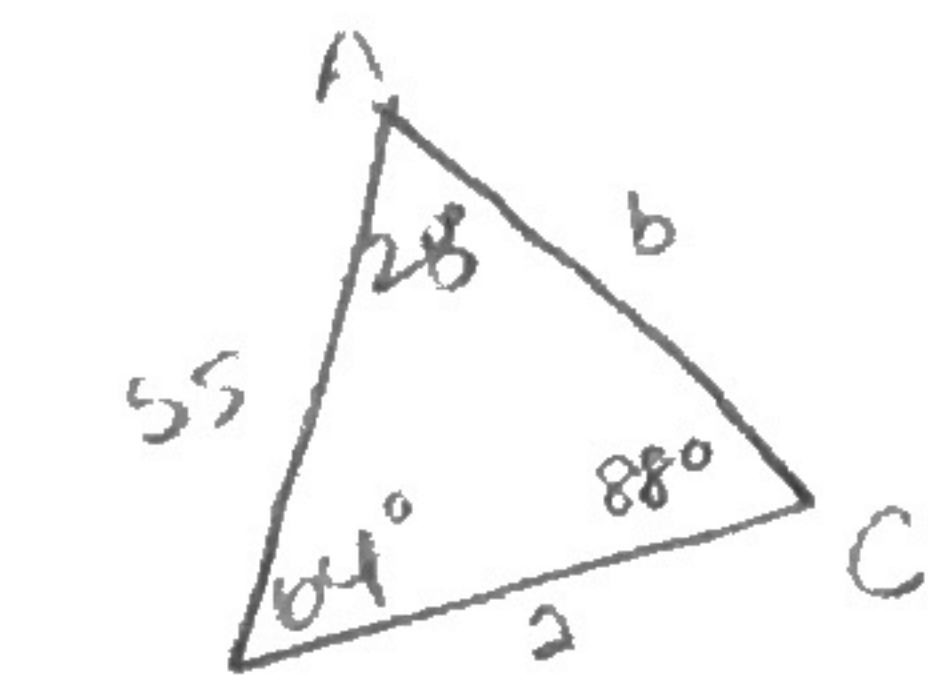
$$c \approx 6.7$$

$$m\angle C = 43.7^\circ$$

$$m\angle B = \sin^{-1}\left(\frac{4 \sin 112}{9}\right)$$

$$m\angle B \approx 24.3^\circ$$

47. $m\angle A = 28^\circ, m\angle B = 64^\circ, c = 55$



$$\frac{\sin 28}{a} = \frac{\sin 64}{55}$$

$$\frac{\sin 64}{55} = \frac{\sin 104}{b}$$

$$a \sin 64 = 55 \sin 28$$

$$b \sin 64 = 55 \sin 104$$

$$a = \frac{55 \sin 28}{\sin 64}$$

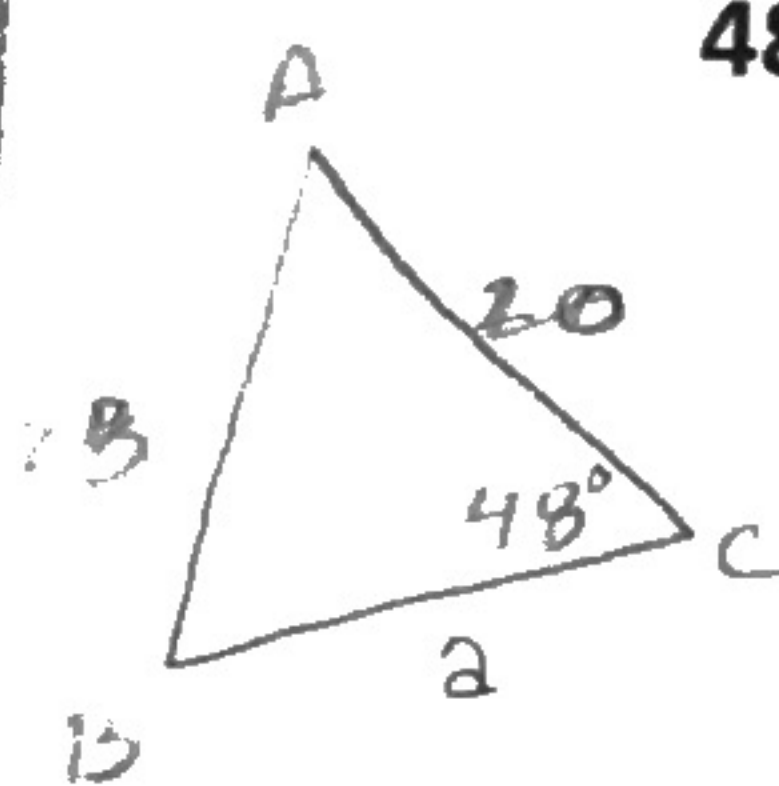
$$b = \frac{55 \sin 104}{\sin 64}$$

$$a \approx 25.8$$

$$b \approx 49.5$$

$$m\angle C = 88^\circ$$

48. $m\angle C = 48^\circ, b = 20, c = 28$



$$\frac{\sin 48^\circ}{28} = \frac{\sin B}{20}$$

$$28 \sin B = 20 \sin 48$$

$$\sin B = \frac{20 \sin 48}{28}$$

$$m\angle A = 99.9^\circ$$

$$m\angle B = \sin^{-1}\left(\frac{20 \sin 48}{28}\right)$$

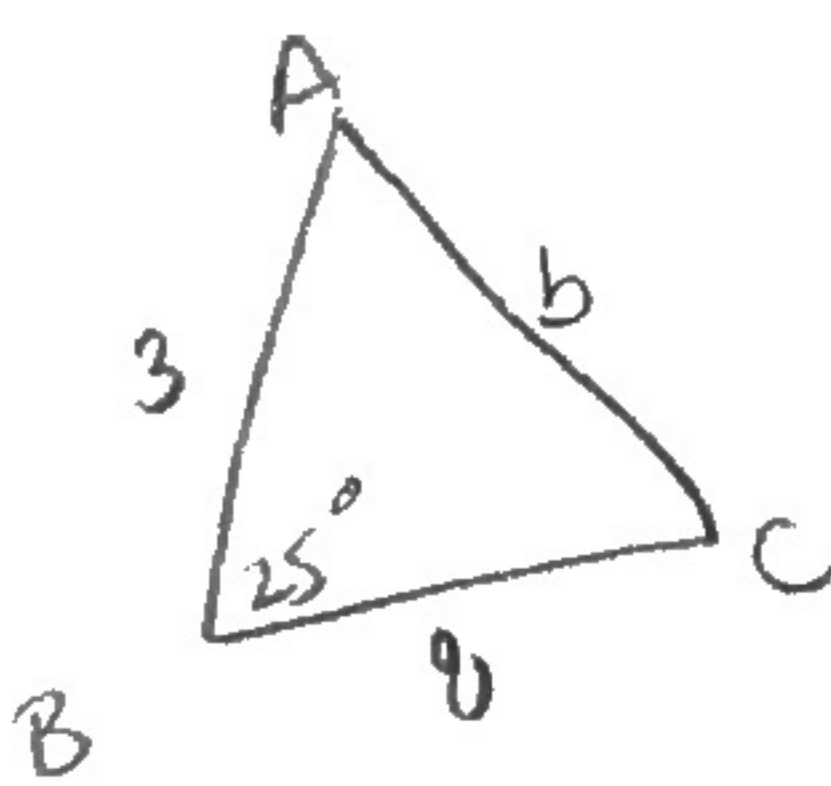
$$m\angle B \approx 32.1^\circ$$

$$a^2 = 20^2 + 28^2 - 2(20)(28) \cos 99.9$$

$$a^2 = 1376.560592$$

$$a \approx 37.1$$

49. $m\angle B = 25^\circ, a = 8, c = 3$



$$b^2 = 8^2 + 3^2 - 2(8)(3) \cos 25^\circ$$

$$b^2 = 29.4972 \dots$$

$$b \approx 5.4$$

$$\frac{\sin 25}{5.4} = \frac{\sin A}{8}$$

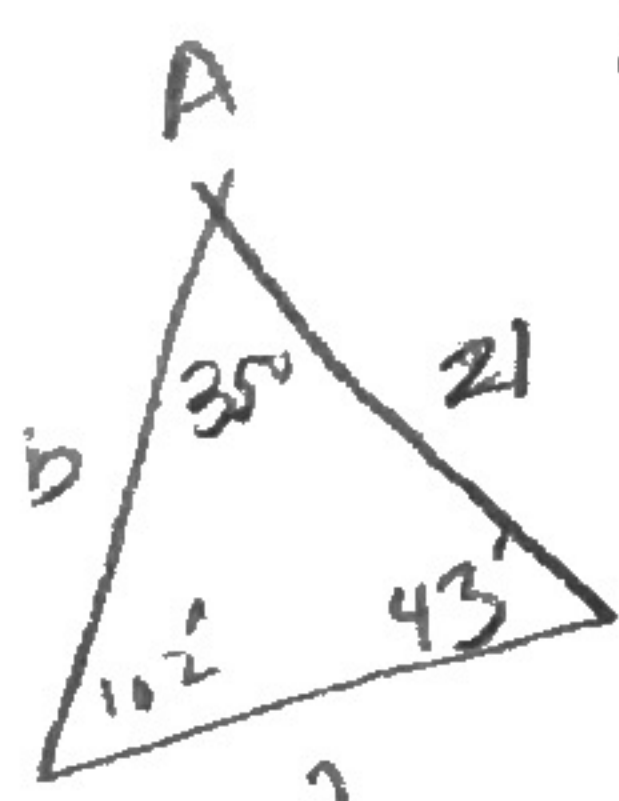
$$5.4 \sin A = 8 \sin 25$$

$$\sin A = \frac{8 \sin 25}{5.4}$$

$$m\angle A = \sin^{-1}\left(\frac{8 \sin 25}{5.4}\right) \approx 38.8^\circ$$

$$m\angle C = 116.2^\circ$$

50. $m\angle B = 102^\circ, m\angle C = 43^\circ, b = 21$



$$\frac{\sin 35^\circ}{2} = \frac{\sin 102}{21}$$

$$2 \sin 102 = 21 \sin 35$$

$$2 = \frac{21 \sin 35}{\sin 102}$$

$$2 \approx 12.3$$

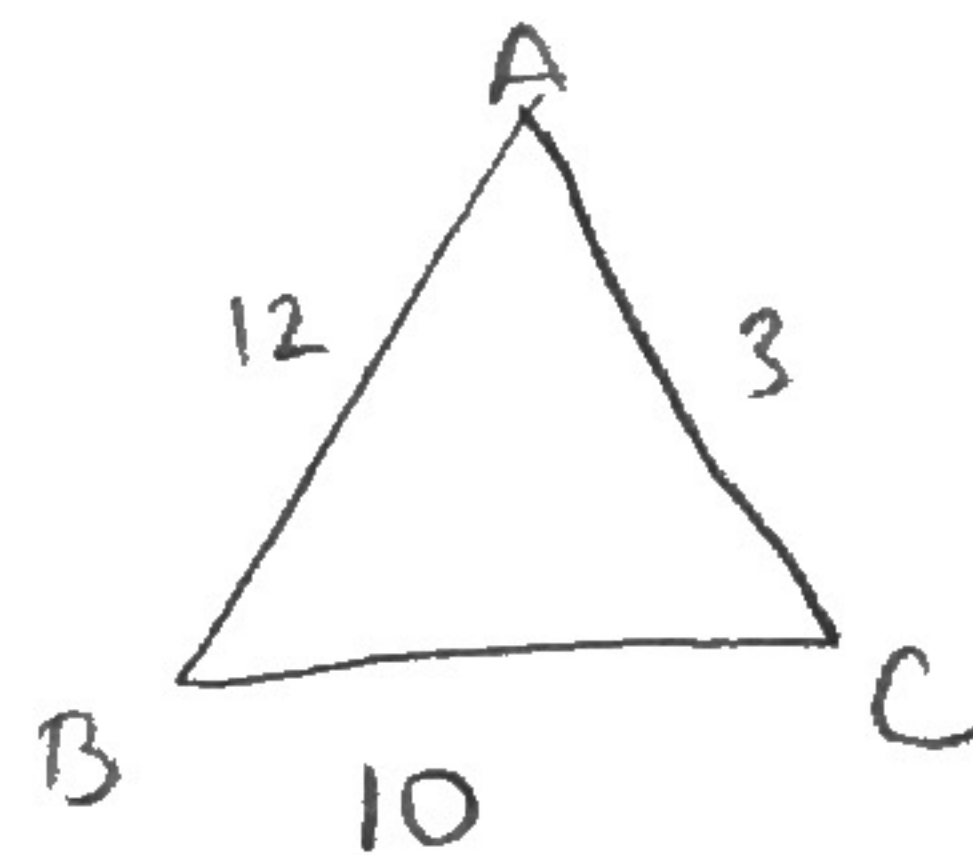
$$\frac{\sin 43^\circ}{b} = \frac{\sin 102}{21}$$

$$b \sin 102 = 21 \sin 43$$

$$b = \frac{21 \sin 43}{\sin 102}$$

$$b \approx 14.6$$

51. $a = 10, b = 3, c = 12$



$$10^2 = 3^2 + 12^2 - 2(3)(12) \cos A$$

$$100 = 9 + 144 - 72 \cos A$$

$$100 = 153 - 72 \cos A$$

$$-53 = -72 \cos A$$

$$0.7361 = \cos A$$

$$m\angle A = \cos^{-1}(0.7361) \approx 42.6^\circ$$

$$3^2 = 10^2 + 12^2 - 2(10)(12) \cos B$$

$$9 = 100 + 144 - 240 \cos B$$

$$9 = 244 - 240 \cos B$$

$$-235 = -240 \cos B$$

$$0.9791 = \cos B$$

$$m\angle B = \cos^{-1}(0.9791 \dots) \approx 11.7^\circ$$

$$m\angle C = 125.7^\circ$$