

Student Name: KEY

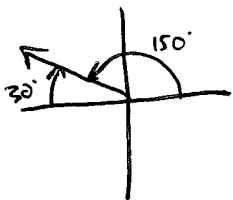
Show all relevant work (use back of pages for scratch paper, if needed). **CIRCLE FINAL ANSWERS.**

1. [35 pts] The first column of the chart below shows angle, θ , measured in degrees. In each row convert θ to radians, then show exact values (write answers as fractions, *not* decimals) of the trigonometric functions. If a value is undefined, write "undef."

θ in degrees	θ in radians	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
0°	0	0	1	0	undef	1	undef
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	2	$\frac{2}{\sqrt{3}}$	$\sqrt{3}$
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	$\sqrt{2}$	$\sqrt{2}$	1
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{2}{\sqrt{3}}$	2	$\frac{1}{\sqrt{3}}$
90°	$\frac{\pi}{2}$	1	0	undef	1	undef	0

2. [5 pts each] Find the exact (fractional, not decimal) value of each part; if undefined, write "undefined".

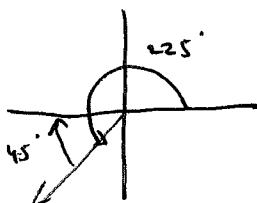
(a) $\tan(-210^\circ) = \tan 150^\circ = \boxed{-\frac{1}{\sqrt{3}}}$



$\tan 30^\circ = \frac{1}{\sqrt{3}}$

(b) $\csc \frac{5\pi}{4} = \csc 225^\circ = \boxed{-\sqrt{2}}$

$\left(\frac{5\pi}{4}\right) \left(\frac{180^\circ}{\pi}\right) = 225^\circ$



$\csc 45^\circ = \sqrt{2}$

3. [5 pts] Which of the five angles below are coterminal with an angle of measure 505° (you may need to circle more than one answer)?

145°

605°

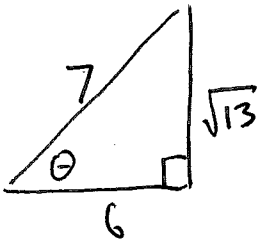
-505°

865°

-215°

4. [5 pts] Find the exact value (fractional, not decimal) of $\cot(\sin^{-1}(\frac{\sqrt{13}}{7}))$

$$\cot(\underbrace{\sin^{-1}(\frac{\sqrt{13}}{7})}_{\theta}) = \boxed{\frac{6}{\sqrt{13}}}$$



$$\begin{aligned} 7^2 &= \sqrt{13}^2 + b^2 \\ 49 &= 13 + b^2 \\ 36 &= b^2 \\ b &= 6 \end{aligned}$$

5. [10 pts] Given θ in Quadrant II and the value of $\cot \theta$, find the exact values (fractional, not decimal) of the remaining trigonometric functions:

$$\sin \theta = \frac{6}{\sqrt{61}}$$

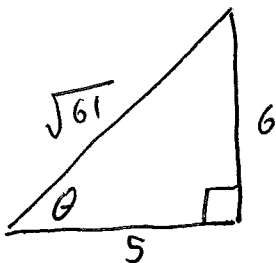
$$\csc \theta = \frac{\sqrt{61}}{6}$$

$$\cos \theta = -\frac{5}{\sqrt{61}}$$

$$\sec \theta = -\frac{\sqrt{61}}{5}$$

$$\tan \theta = -\frac{6}{5}$$

$$\cot \theta = -\frac{5}{6}$$



$$\begin{aligned} 6^2 + 5^2 &= c^2 \\ 36 + 25 &= c^2 \\ 61 &= c^2 \\ c &= \sqrt{61} \end{aligned}$$

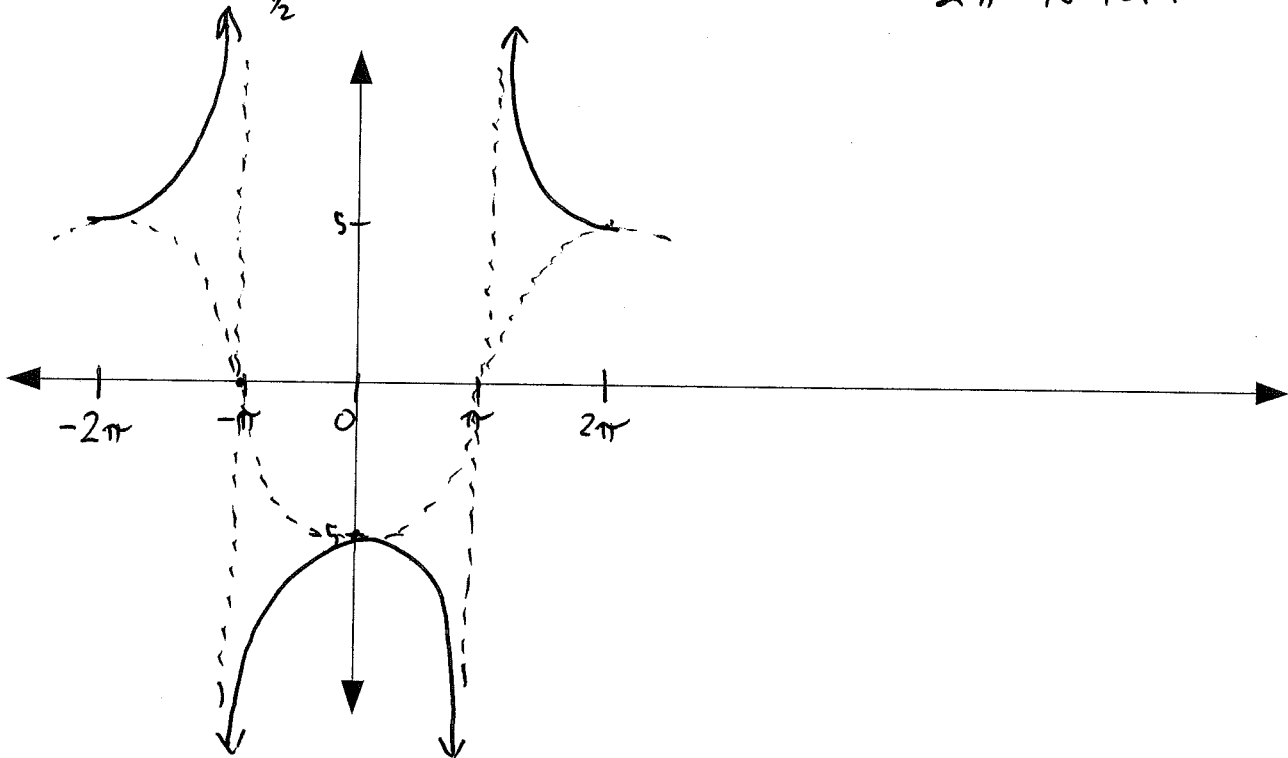
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6. [10 pts] Find the period length, and phase shift of the function $y = 5 \sec\left(\frac{1}{2}x + \pi\right)$. Then graph one period and label all relevant points along the axes.

$$= 5 \sec \frac{1}{2}(x + 2\pi)$$

$$\text{Period Length} = \frac{2\pi}{\frac{1}{2}} = 4\pi$$

$$\text{Horizontal Shift} = 2\pi \text{ to left}$$



7. [10 pts] A 250 foot support cable is attached to the top of a 80 foot flagpole. The flagpole itself is mounted at the top of a hill that has an angle of inclination of 35° . How far down the side of hill will the cable reach, as measured from the base of the pole (distance d in the figure)? Express your answer to the nearest foot. *Hint: extend the flagpole downward through the hill to form a right triangle, and use geometry to determine the resulting angles.*

$$\frac{\sin 125^\circ}{250} = \frac{\sin \phi}{80}$$

$$\sin \phi = \frac{80 \sin 125^\circ}{250}$$

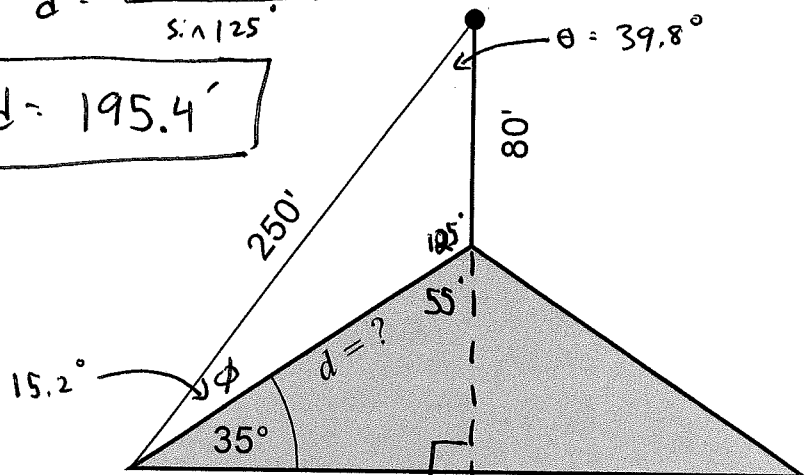
$$\phi = \sin^{-1}\left(\frac{80 \sin 125^\circ}{250}\right)$$

$$\phi = 15.2^\circ$$

$$\frac{\sin 125^\circ}{250} = \frac{\sin 39.8^\circ}{d}$$

$$d = \frac{250 \sin 39.8^\circ}{\sin 125^\circ}$$

$$d = 195.4'$$

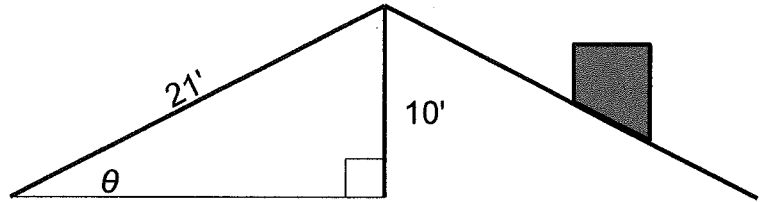


8. [10 pts] A cross section of a house's roof shows that the height of the roof is 10 feet while the length from the edge to to the peak is 21 feet. How steep is the angle of inclination of the roof (labeled as θ in the diagram)? Express your answer in degrees, accurate to one decimal place.

$$\sin \theta = \frac{10}{21}$$

$$\theta = \sin^{-1}\left(\frac{10}{21}\right)$$

$$\theta = 28.4^\circ$$



9. [10 pts] Given the following information, solve for all possible triangles. If no triangle is possible, write, "Impossible." If, two triangles are possible, circle both sets of values. Express final side lengths and angle measurements to one decimal place.

$$\angle A = 25.2^\circ$$

$$a = 3.0$$

SSS
Law of
Cosines.

$$\angle B = 96.4^\circ$$

$$b = 7.0$$

$$\angle C = 58.4^\circ$$

$$c = 6.0$$

$$3^2 = 7^2 + 6^2 - 2(7)(6) \cos A$$

$$9 = 49 + 36 - 84 \cos A$$

$$9 = 85 - 84 \cos A$$

$$-76 = -84 \cos A$$

$$\cos A = \frac{76}{84}$$

$$A = \cos^{-1}\left(\frac{76}{84}\right)$$

$$A = 25.2^\circ$$

$$7^2 = 3^2 + 6^2 - 2(3)(6) \cos B$$

$$49 = 9 + 36 - 36 \cos B$$

$$49 = 45 - 36 \cos B$$

$$4 = -36 \cos B$$

$$\cos B = \frac{-4}{36}$$

$$B = \cos^{-1}\left(\frac{-1}{9}\right)$$

$$B = 96.4^\circ$$

$$6^2 = 3^2 + 7^2 - 2(3)(7) \cos C$$

$$36 = 9 + 49 - 42 \cos C$$

$$36 = 58 - 42 \cos C$$

$$-22 = -42 \cos C$$

$$\cos C = \frac{22}{42}$$

$$C = \cos^{-1}\left(\frac{11}{21}\right)$$

$$C = 58.4^\circ$$