Worksheet Seven **MATH 104** Name:________________

WORK ON THIS ASSIGNMENT IN GROUP OF 2-4. TURN IN YOUR WORK INDIVIDUALLY IN CLASS. YOU CAN USE YOUR NOTES FOR THIS ASSIGNMENT.

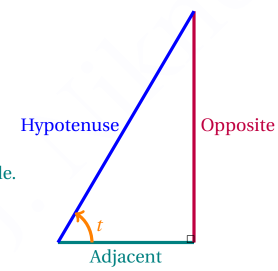
5.4: The Right Triangle Trigonometry

- **The Trigonometric Ratios**

$$\sin(t) = \frac{\text{opposite}}{\text{hypotenuse}} \text{ (SOH)} \qquad \tan(t) = \frac{\text{opposite}}{\text{adjacent}} \text{ (TOA)} \qquad \sec(t) = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\cos(t) = \frac{\text{adjacent}}{\text{hypotenuse}} \text{ (CAH)} \qquad \cot(t) = \frac{\text{adjacent}}{\text{opposite}} \qquad \csc(t) = \frac{\text{hypotenuse}}{\text{opposite}}$$

Hypotenuse is the side opposite of the right angle.
Adjacent is the side next to the angle t and the right angle.
Opposite is the side opposite of angle t.



- In the previous sections, we learned how to use a reference angle table $(0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi)$ to find the trigonometric values of the special angles. Another method is to use the right triangle to find the trigonometric values for unknown reference angle. In this method, you set up a triangle using the given trigonometric values and then you solve for unknown side using Pythagorean Theorem. Then find all the other trigonometric values using the length of sides of the triangle.

  Now, you can complete Questions 1-5.

- **Cofunction Identities** Observing the complementary angles, we can show the following.

$$\sin\left(\frac{\pi}{2} - u\right) = \cos(u) \qquad \cot\left(\frac{\pi}{2} - u\right) = \tan(u)$$

$$\cos\left(\frac{\pi}{2} - u\right) = \sin(u) \qquad \sec\left(\frac{\pi}{2} - u\right) = \csc(u)$$

$$\tan\left(\frac{\pi}{2} - u\right) = \cot(u)$$

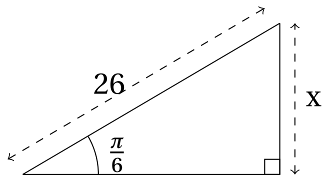
- **Line of Sight**: If an observer is looking at something, the line from the eye of the observer to the object is the line of sight.

- **Angle of Elevation** If the object is above the horizontal, the angle between line of sight and the horizon.

- **Angle of Depression** If the object is below the horizontal, the angle between line of sight and the horizon.

- *Now, you can complete Question 6.*

1. Use a trig function to find x:



(A) what are the values of $\sin\left(\frac{\pi}{6}\right)$ and $\cos\left(\frac{\pi}{6}\right)$?

(B) What trig value is equal to $\frac{x}{26}$?

(C) Find x using Part (A) and Part (B).

2. Given that $\cos\theta = \frac{2}{5}$ and $\sin\theta < 0$, the exact value of $\tan\theta$ is

(a) $-\frac{5}{2}$

(b) $-\frac{\sqrt{21}}{2}$

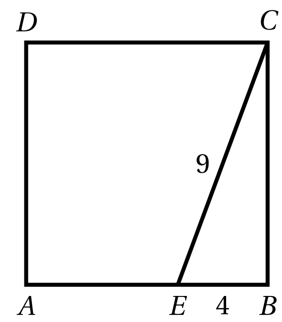
(c) $-\frac{\sqrt{21}}{5}$

(d) $\frac{\sqrt{21}}{2}$

3. If $\sin(\theta) = \frac{4}{5}$ and $0 \le \theta \le \frac{\pi}{2}$, then $\tan(\theta) =$

(A) $\frac{4}{3}$ (B) $\frac{3}{4}$ (C) $\frac{3}{5}$ (D) $\frac{5}{3}$ (E) $\frac{4}{5}$ (F) $\frac{5}{4}$

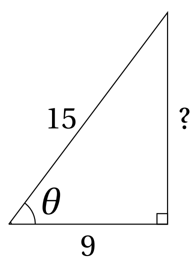
4. The area of square ABCD shown to the right is

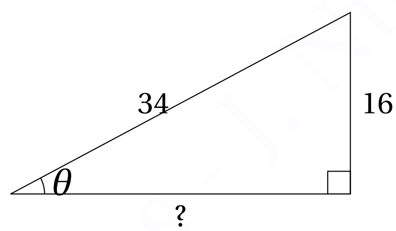


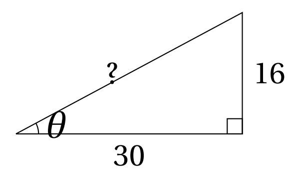
(A) 9 (C) 33 (E) 49 (G) 72

(B) $\sqrt{13}$ (D) 40 (F) 65 (H) 81

5. Find the length of the missing side and complete the table for each of the triangles.







$\cos(\theta) =$	$\sin(\theta) =$
$\cot(\theta) =$	$\tan(\theta) =$
$\csc(\theta) =$	$\sec(\theta) =$

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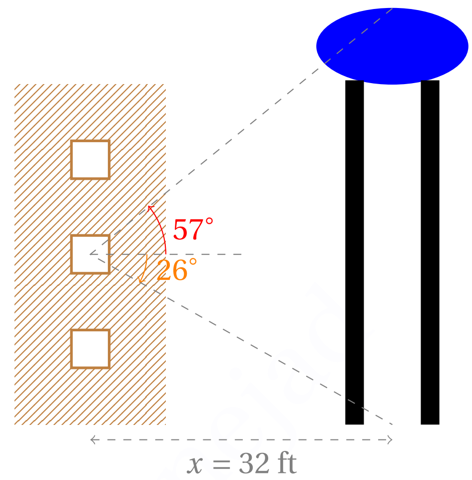
6. **Architecture, Land Surveying and Civil engineering:** A water tower is located $x = 32$ ft from a building (see the figure). From a window in the building, Debaditya notes that the angle of elevation to the top of the tower is 57° and that the angle of depression to the bottom of the tower is 26°.

(A) How high is the window?



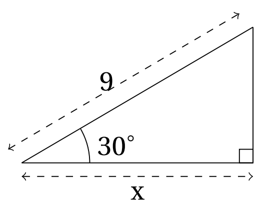
(B) How tall is the tower?

INDIVIDUAL WORK

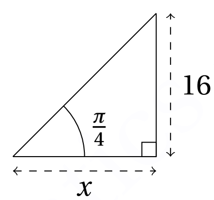
UPLOAD TO CANVAS OR SUBMIT IN CLASS BEFORE DUE DATE. DISCUSSING THESE QUESTIONS IN YOUR GROUP IS ENCOURAGED BUT MAKE SURE YOU ARE TURNING IN YOUR OWN WORK.

7. The right angles, some other angles and some of the lengths are marked on the following triangles. Find the length x in each case.

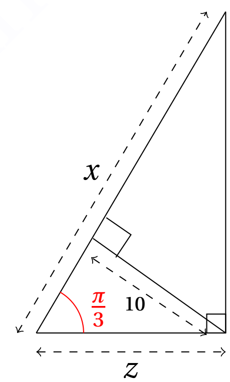
(A) *(0.75 points)*



(B) *(0.74 points)*



(C) *(1 point)*
(Hint: First solve for z.)

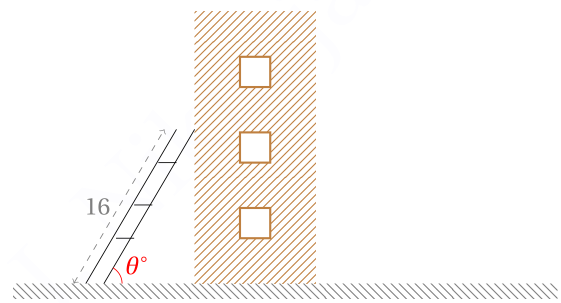


8. Kathryn is observing a 16-ft ladder leaning against a building. **The first time she notices the ladder**, the angle between the ground and the ladder, θ, is 45°. She notices that the the ladder is sliding away and the height is **decreasing** at rate $0.1 ft/sec$.

   (A) *(1 point)* How high does the ladder reach on the building when Kathryn first notices it?

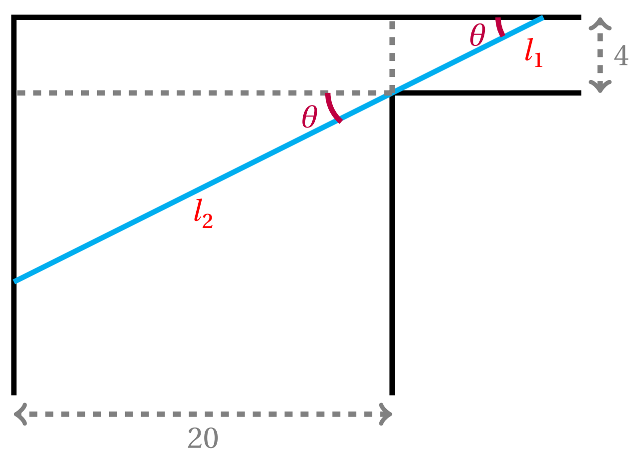
   (B) *(0.75 point)* Express the height of the ladder, h, as a function of time, t, in seconds. *(In terms of t.)*

   (C) *(1 point)* Express $\sin(\theta)$ in terms of t.



   (D) *(0.25 points)* Is θ increasing or decreasing?

Architecture and Civil engineering:



9. *(2.5 points)* Mark is carrying a pole horizontally around a corner joining corridors of widths 4 feet and 20 feet. The pole gets stuck in the corner, as shown in the figure; making an angle θ with one of the walls. Express the length of the pole in terms of θ.

   Hint: Express each length l_1 and l_2, shown in the figure, in terms of θ, and $l = l_1 + l_2$.