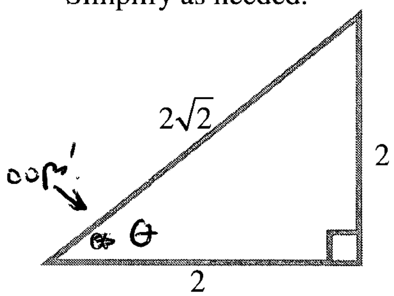
1) (8 points) For the right triangle below, find the six trigonometric functions for the angle α. Simplify as needed.



$\sin\theta = \frac{2}{2\sqrt{2}} = \frac{\sqrt{2}}{2}$ $\quad$ $\csc\theta = \frac{2\sqrt{2}}{2} = \sqrt{2}$

$\cos\theta = \frac{2}{2\sqrt{2}} = \frac{\sqrt{2}}{2}$ $\quad$ $\sec\theta = \frac{2\sqrt{2}}{2} = \sqrt{2}$

$\tan\theta = \frac{2}{2} = 1$ $\quad$ $\cot\theta = \frac{2}{2} = 1$

2) (2 points) What is the measurement of the angle $\cancel{\alpha}$ θ from number 1? $\underline{45^\circ}$

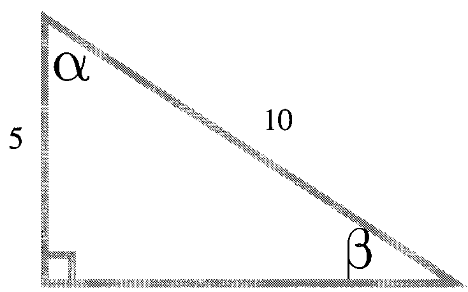
3) (1 point each) Fill in the blank:

a) The sine function is <u>red</u> to cosine but <u>blue</u> to cosecant.

b) The cosine function is <u>yellow</u> to sine but <u>green</u> to secant.

c) The tangent function is <u>purple</u> and <u>banana</u> to cotangent.

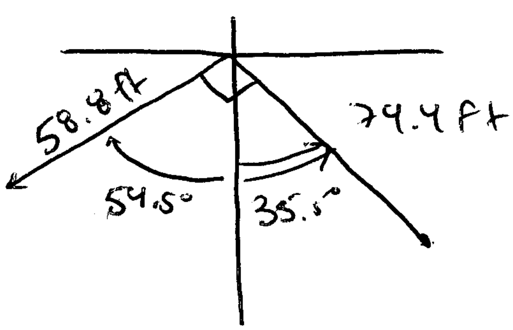
4) (6 points) For the right triangle below, find the missing angles **by using only the numbers given**. Do not find β from α or vice versa. Round answers to two decimal places:



$\alpha = \cos^{-1}\frac{5}{10} = 60^\circ$

$\beta = \sin^{-1}\frac{5}{10} = 30^\circ$

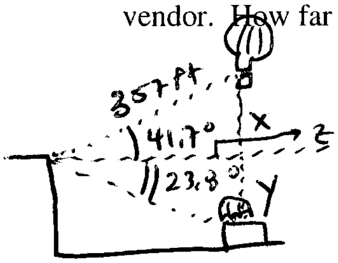
5) (7 points) Standing right next to each other, two students hear Mike announce a test and begin to run away in different directions. The first student runs on a bearing of $S35.5^\circ E$ at a speed of 6.2 feet per second. The second student runs on a bearing of $S54.5^\circ W$ at a speed of 4.9 feet per second. After 12 seconds, how far apart are the students? Round answer to two decimal places.



$d = \sqrt{58.8^2 + 74.4^2}$

$\approx \boxed{94.83\text{ ft}}$

6) (6 points) Standing at the edge of a cliff and looking up $41.7°$, you see a hot air balloon 357 feet away. Looking down $23.8°$, and directly below the hot air balloon, you see a lonely hot dog vendor. How far above the hot dog vendor is the hot air balloon?



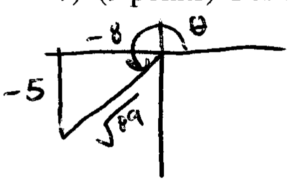
$\sin 41.7° = \frac{x}{357} \Rightarrow x = 357 \sin 41.7° \approx 237.49$ ft

$z = \sqrt{357^2 - 237.49^2} \approx 266.55$ ft

$\tan 23.8° = \frac{y}{266.55} \Rightarrow y = 266.55 \tan 23.8° \approx 117.56$ ft

$\boxed{x+y = 355.05 \text{ ft}}$

7) (9 points) For the angle θ in Quadrant ~~II~~ III where $\tan\theta = \frac{5}{8}$, find the 5 other trig functions:



$\sin\theta = \frac{-5\sqrt{89}}{89}$ $\quad$ $\csc\theta = \frac{\sqrt{89}}{-5}$

$\cos\theta = \frac{-8\sqrt{89}}{89}$ $\quad$ $\sec\theta = \frac{\sqrt{89}}{-8}$

$\tan\theta = \frac{5}{8}$ $\quad$ $\cot\theta = \frac{8}{5}$

8) (3 points each) Convert as directed. Show all necessary work:

a) $18.645°$ to DMS notation:

$.645° \cdot \frac{60'}{1°} = 38.7'$

$.7' \cdot \frac{60''}{1'} = 42''$

$18° 38' 42''$

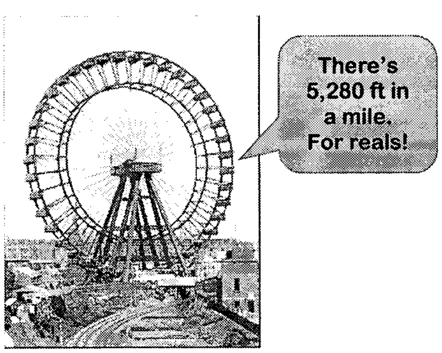
b) $12°$ to radians:

$\frac{12°}{1} \cdot \frac{\pi}{180°} = \boxed{\frac{\pi}{15}}$

c) $\frac{11\pi}{12}$ to degrees:

$\frac{11\pi}{12} \cdot \frac{180°}{\pi} = \boxed{165°}$

9) (7 points) A Ferris wheel pulled by bad, bad students that do not do their homework rotates at a rate of 8.25 revolutions per minute. The diameter of the Ferris wheel is 36.8 feet. Determine how fast a point on the tip of the Ferris wheel is traveling in miles per hour. Round to three decimal places.



$v = r \cdot \omega$

$r = \frac{18.4 \text{ ft}}{1 \text{ rad}} \cdot \frac{1 \text{ mi}}{5280 \text{ ft}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} = \frac{36.8\pi \text{ mi}}{5280 \text{ ft}}$

$\omega = \frac{8.25 \text{ rev}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = \frac{495 \text{ rev}}{1 \text{ hr}}$

$v = \frac{36.8\pi \text{ mi}}{5280 \text{ rev}} \cdot \frac{495 \text{ rev}}{1 \text{ hr}} \approx \boxed{10.84 \text{ mph}}$

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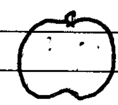
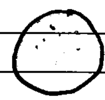
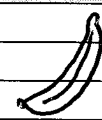
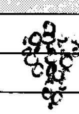
10) (3 points) Short answer: Explain why the functions tangent, cotangent, secant, and cosecant have vertical asymptotes: There's always money in the banana stand

11) (1 point per box) Fill in the blank with the words "even" or "odd" to describe the type of function and then the correct value for the period:

	Type of Function	Period
Sine		
Cosine		
Tangent		

	Type of Function	Period
Cosecant		
Secant		
Cotangent		

12) (3 points each) Given the point $\left(-\frac{\pi}{3},-\frac{\sqrt{3}}{2}\right)$ on the graph of $y=\sin\theta$, find the **exact value** of the coordinates of the point under the transformation below:

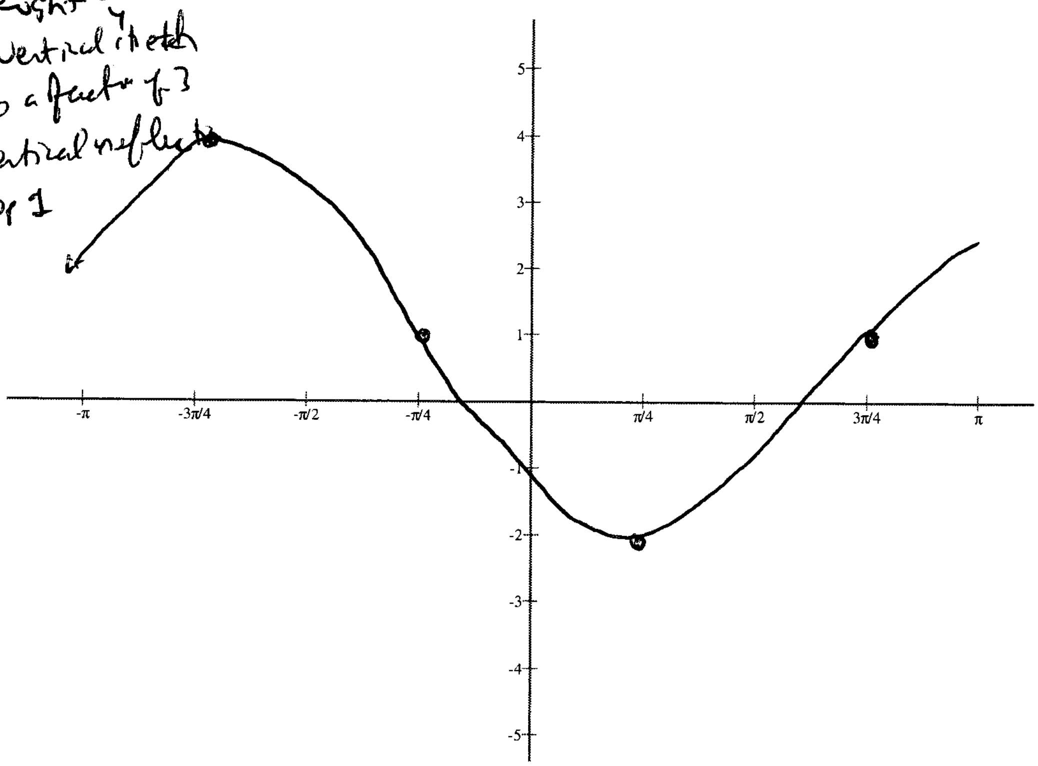
a) $y=4\sin\theta$ b) $y=\sin\theta+2$ c) $y=\sin(4\theta)$ d) $y=\sin(\theta-\pi)$

$\left(-\frac{\pi}{3}, -2\sqrt{3}\right)$ $\left(-\frac{\pi}{3}, -\frac{\sqrt{3}}{2}+2\right)$ $\left(-\frac{\pi}{12}, -\frac{\sqrt{3}}{2}\right)$ $\left(\frac{2\pi}{3}, -\frac{\sqrt{3}}{2}\right)$

13) (10 points part *a*; 3 points each part *b*) For the function $y=-3\cos\left(\theta-\frac{\pi}{4}\right)+1$:

a) Sketch a graph of the function below.
Fill in the whole axis from $[-\pi,\pi]$:

1) Right $\frac{\pi}{4}$
2) Vertical stretch by a factor of 3
3) Vertical reflection
4) up 1



b) Determine the following:

i) Domain

$\mathbb{R}$

ii) Range

$[-2, 4]$

iii) Amplitude

3

iv) Phase Shift

$\frac{\pi}{4}$ right

v) Period

2π

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