Classroom Examples for Pre-Calculus #12

*Put graphs on screen – don't try to draw them
*Discuss how bearings work $N67°18'48"E$

Sine starts at 0,0 and goes up with period of 2Pi
Cosine starts at 0,1 and goes down with period of 2Pi
Tangent goes from –pi/2 to pi/2 going up to the right with period of Pi
Cotangent goes from 0 to pi going down to the right with a period of Pi

*With tangent, the center of the curve doesn't move with period change
*With cotangent, the center moves with period change but the left asymptote at 0 never moves with period change
*Cosecant goes from asymptote to asymptote
*Secant goes from center of U to center of next U

1) The rear tires on a Jaguar have a diameter of 42 inches. If, while driving, the angular velocity of a rear tire of this car is 3824 degrees per second, what is the linear velocity of the Jaguar (rounded to one decimal place) in miles per hour?

2) A fishing boat is located due west of a lighthouse and a tug boat is exactly 25 miles due south of the fishing boat. If the bearing from the tug boat to the lighthouse is exactly $N67°18'48"E$, how far away (in miles rounded to one decimal place) is the tug boat from the lighthouse?

3) If $y = -4\sin(3x - \pi) - 2$, determine if the graph is inverted, find the amplitude, period, phase shift, vertical shift and graph the function based on these answers and your knowledge of the cosine function.

4) Two pulleys, of different sizes, are connected by a belt. If the diameter of the larger pulley is 45 inches and it is turning with an angular velocity of 960 degrees per second, how fast is the smaller pulley, which has a diameter of 14 inches, rotating in revolutions per minute?

5) Nina is in a hot-air balloon that is floating at an altitude of 6704 feet. She looks off into the distances and sees that the balloon is headed straight towards two towns. If, when she looks directly at the town furthest away, her angle of depression is 21 degrees and, when she looks directly at the town closest to her, her angle of depression is 44 degrees, how far away (in miles rounded to once decimal place) are the towns from one another?

6) Use the following graph to determine the type of trigonometric function involved, the amplitude, period, phase shift, vertical shift of this function and then use this information to write the equation of this function in standard form.
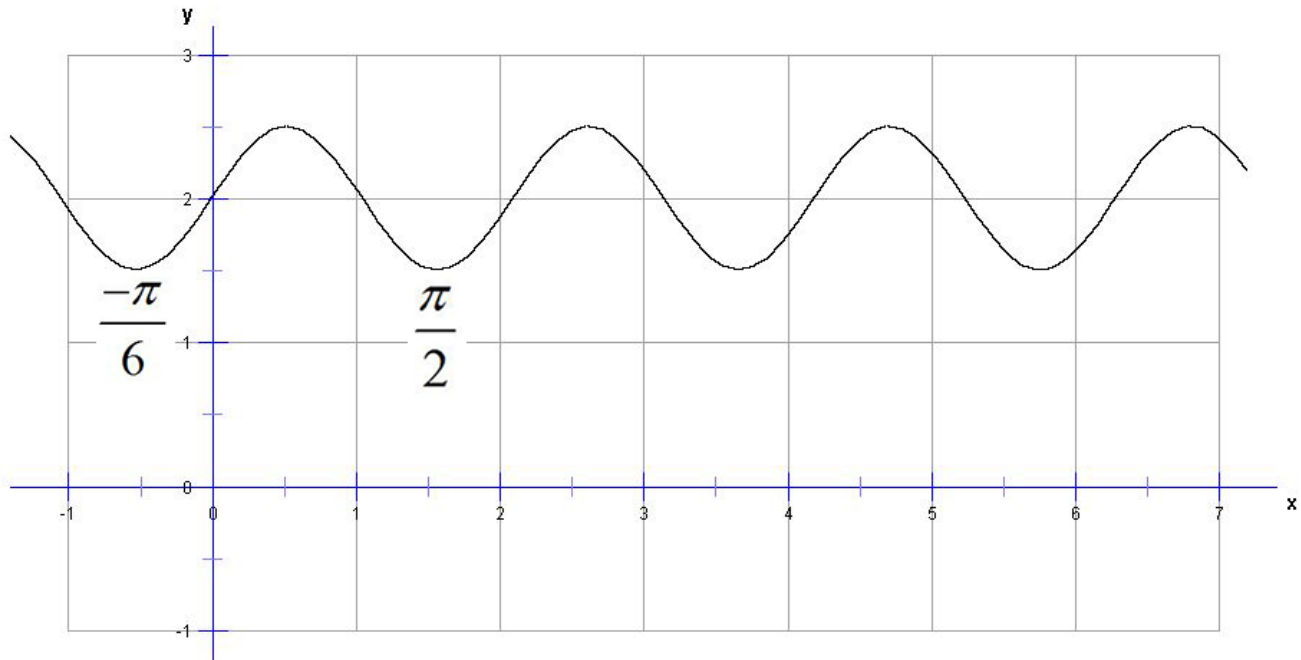

7) Jupiter has a radius of 43,441 miles and one day on Jupiter last 10 hours. If you were standing on the surface of Jupiter at some point on its equator, what is your linear velocity (rounded to one decimal place) in miles per hour?

8) Silas and Joe take a trip to Paris to see the Eiffel Tower. Standing near the base of the tower, Joe looks up at the top of the tower using an angle of elevation of 64 degrees. If Silas walks exactly 180 feet closer to the base of the tower and sees the top using an angle of elevation of 73 degrees, how tall (in feet rounded to one decimal place) is the Eiffel Tower?

9) If $y = 2\csc(4x + \pi) + 3$, determine if the graph is inverted, find the amplitude, period, phase shift, vertical shift and graph the function based on these answers and your knowledge of the cosine function.

10) Adam buys a damn on a river in the hopes of creating his own green energy from the power of the water that flows over the top of the damn. In order for Adam's generator to operate properly and provide him with the electricity he needs, the rotor attached to the turbine must spin with an angular velocity of 1420 degrees per second. If the water going over the damn has a linear velocity of 12 miles per hour, how large (in feet rounded to one decimal place) must the diameter of a waterwheel be in order for Adam's generator to operate properly?

11) Use the following graph to determine the type of trigonometric function involved, determine if the graph is inverted, period, phase shift, vertical shift of this function and then use this information to write the equation of this function in standard form.
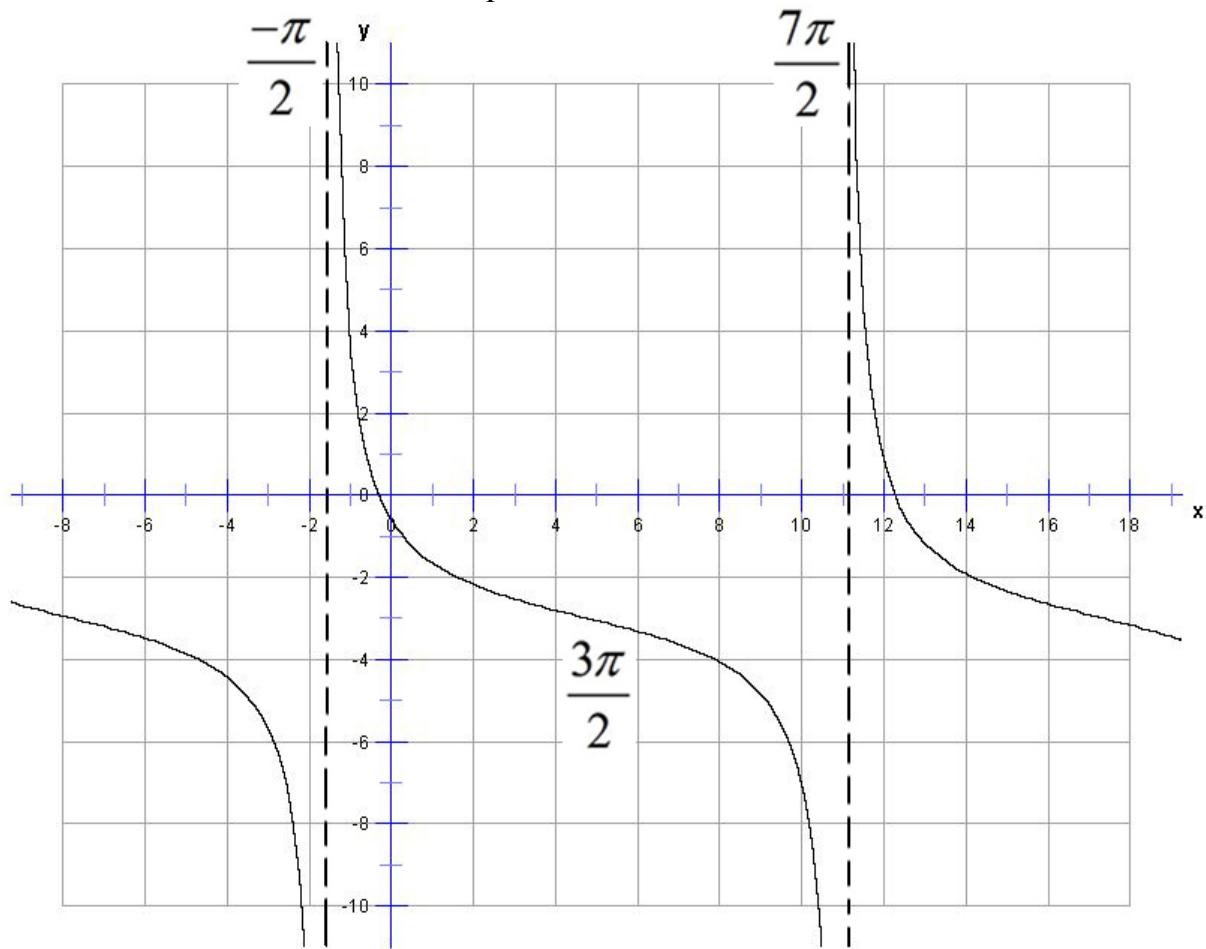
12) Joshua and Emily decide to try to measure the width of the Delaware River at the Delaware Water Gap. It is impossible for them to directly measure the width of such a wide river so they decide to use two surveyor's transits and their knowledge of mathematics to estimate the width. Joshua and Emily stand on the bank of the river, and find a tree on the other bank of the river that is directly opposite from their location. Emily then takes the transit and walks 154 feet down the river bank. Joshua uses his transit to make sure that Emily stays on a path that is exactly perpendicular to path from Joshua to the tree. Emily then uses her transit to find that same tree and measures the angle from where Joshua is standing to where the tree is located and finds that it is exactly $72°43'16.4"$. Based on these measurements, how wide is the river at Joshua's location and how far is Emily away from that tree? (give your answers in feet rounded to one decimal place)

13) If $y = -1\cot(\dfrac{1}{2}x - \dfrac{\pi}{6}) + 5$, determine if the graph is inverted, find the amplitude, period, phase shift, vertical shift and graph the function based on these answers and your knowledge of the cosine function.

14) Impressed with her ability to calculate the width of a river without actually being able to measure it, Emily decides to tackle a far more challenging problem. She wants to try to determine the radius of the earth without being able to actually measure it. To accomplish this, Emily packs up her trusty transit and heads to Mount Cadillac in Maine. She climbs to the summit which is at an elevation above sea level of 1530 feet. She sets up her transit and looks out to the east where, on a clear day, you can see the Atlantic Ocean. She sets her transit to point directly at the horizon on the ocean and measures the angle of depression to be $0°41'24.6''$, what is the radius of the earth in miles rounded to one decimal place?

15) Use the following graph to determine the type of trigonometric function involved, determine if the graph is inverted, find the amplitude, period, phase shift, vertical shift of this function and then use this information to write the equation of this function in standard form.
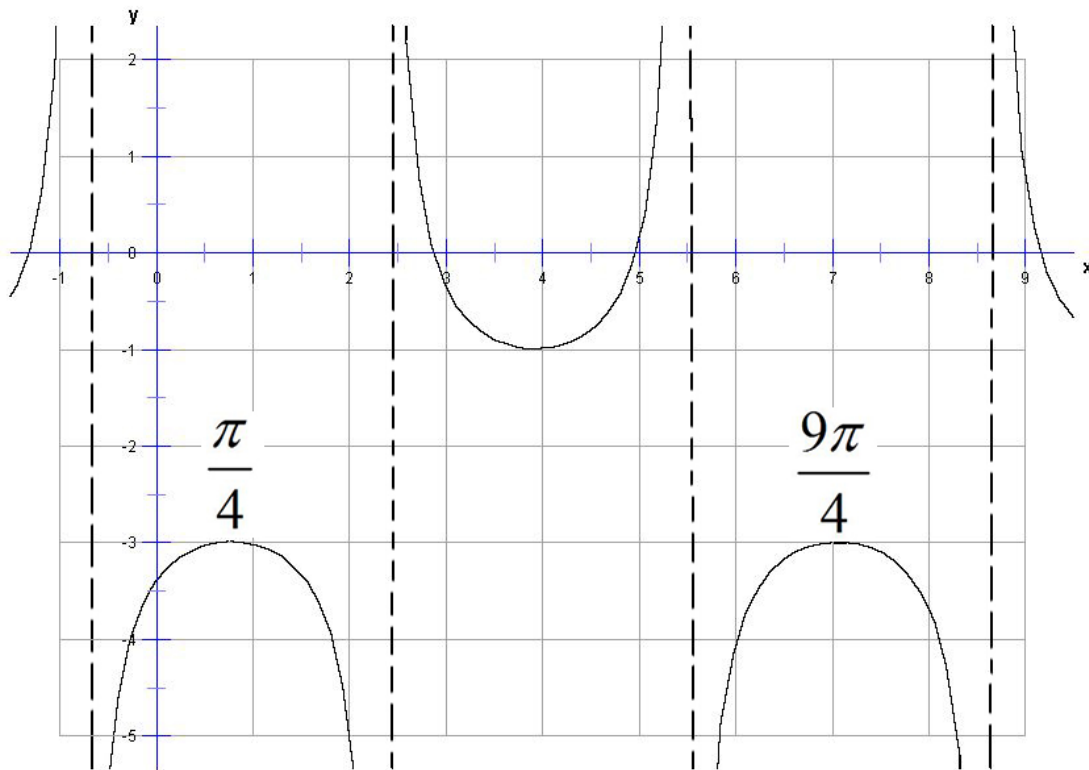
Answers to trig graphs:

$$y = -\frac{1}{2}\cos(3\theta + \frac{\pi}{2}) + 2$$

$$y = -1\tan(\frac{1}{4}\theta - \frac{3\pi}{8}) - 3$$

$$y = -1\sec(\theta - \frac{\pi}{4}) - 2$$