Math130 Trigonometry

First Midterm Exam

Colorado Mesa University · 2025 Spring

NAME: _____

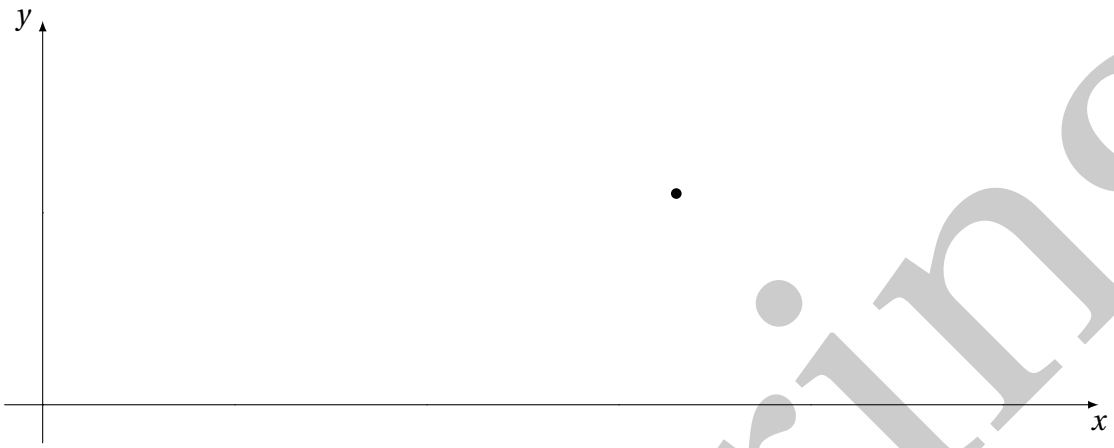
1. Consider the points in the xy-plane with rectangular coordinates $(5,1)$ and $(15,-23)$.

   (a) What is an equation of the line that passes through these two points? Express the equation in the form $y = mx + b$ for some values of m and b.

   (b) What is the length of the segment of that line that lies between the two points?

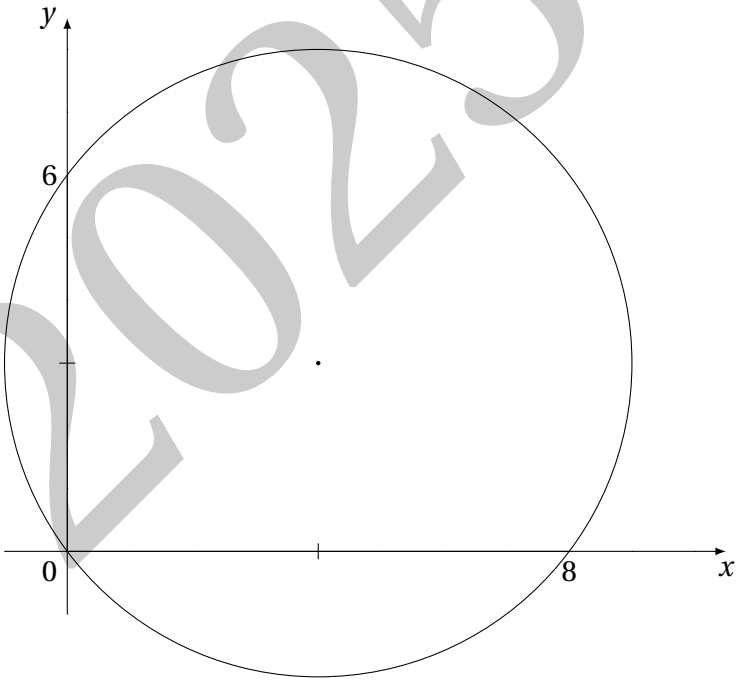
   (c) What are the coordinates of the point on that line that is equally distant to these two points?

2. Measuring in inches, accurate to within a tenth of an inch, what are the coordinates of the point (•) in the rectangular coordinate system defined by the x- and y-axis below.



3. What is an equation of a circle in the xy-plane centered at $(1,-3)$ with a radius of thirteen?

4. Determine an equation for this circle and calculate the circumference of this circle.



5. Hawthorne Park, located in residential downtown Grand Junction, is approximately rectangular with its east and west sides being 360' long and its north and south sides being 460' long.

   (a) Suppose you are standing at the southwest corner of the park and want to meet your friend at the northeast corner. How much shorter of a distance would it be to cut across the park diagonally versus walking around the outside?

   There's a large gazebo located 80' from the south edge of the park and 260' from the west edge of the park. Suppose the Grand Junction Parks and Recreation Department wants to pour a new concrete footpath from the southeast corner of the park to this gazebo.

   (b) How long is the footpath going to be?

   (c) Suppose they also want to install a drinking fountain halfway along this new footpath. The nearest water main runs under the south edge of the park, so to install the water pipes they'll need to dig a straight trench from the fountain's planned location to the water main. How long will the trench need to be?

6. A rain gutter should be installed along a roof at an slant/decline, usually called the *pitch* of the gutter. A common recommendation is that the gutter should drop by ½" for every 12' of roofing.

   (a) What slope does this recommendation correspond to? (Be mindful of units)

   (b) If you have to install a gutter along a 42' length of roofing, how much higher does one end of the gutter be over the other?

   (c) If you have to install a gutter along a 42' length of roofing, what length of gutter do you need?

Math130 Trigonometry

Second Midterm Exam

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NAME: _____

1. What are the *exact values*, expressed in terms of radicals if necessary, of each of the following outputs of a trigonometric function?

   (a) $\cos(\pi)$ (b) $\cos\left(\frac{\pi}{2}\right)$ (c) $\tan\left(\frac{3\pi}{4}\right)$

   (d) $\sin\left(\frac{\pi}{6}\right)$ (e) $\sin\left(\frac{\pi}{4}\right)$ (f) $\sin\left(\frac{\pi}{3}\right)$

   (g) $\cos\left(\frac{7\pi}{6}\right)$ (h) $\sin\left(\frac{4\pi}{3}\right)$ (i) $\tan\left(\frac{\pi}{3}\right)$

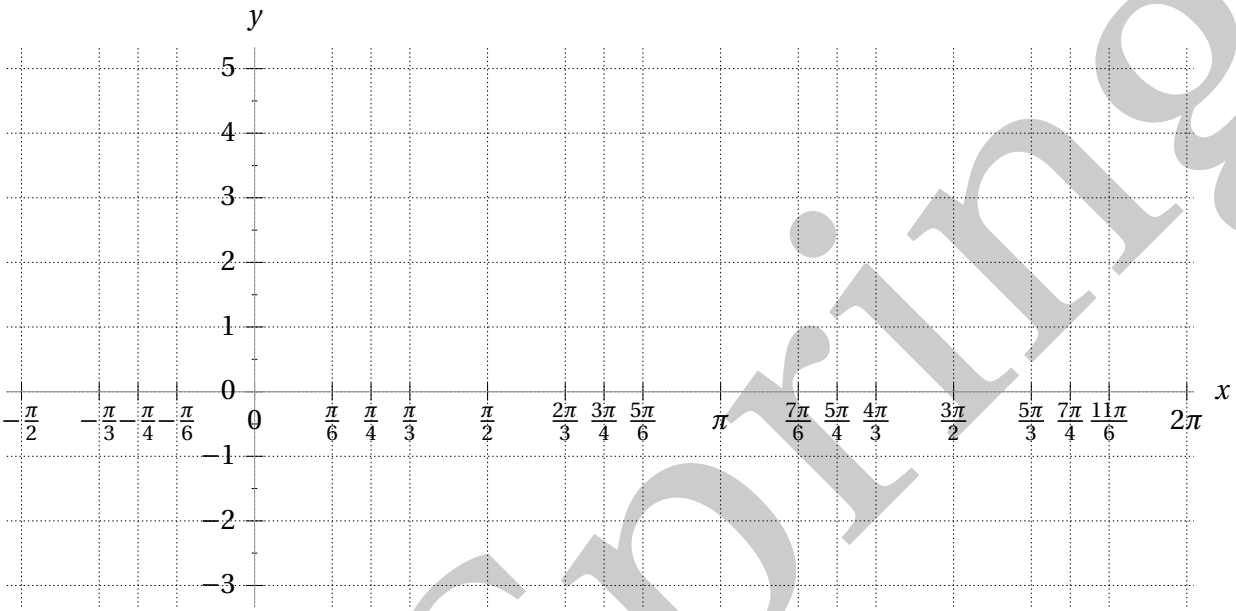
   (j) $\sec\left(\frac{\pi}{6}\right)$ (k) $\csc\left(\frac{-\pi}{3}\right)$ (l) $\cot\left(\frac{\pi}{3}\right)$

2. What is the smallest positive value of t such that $\sin(t) = 1$?

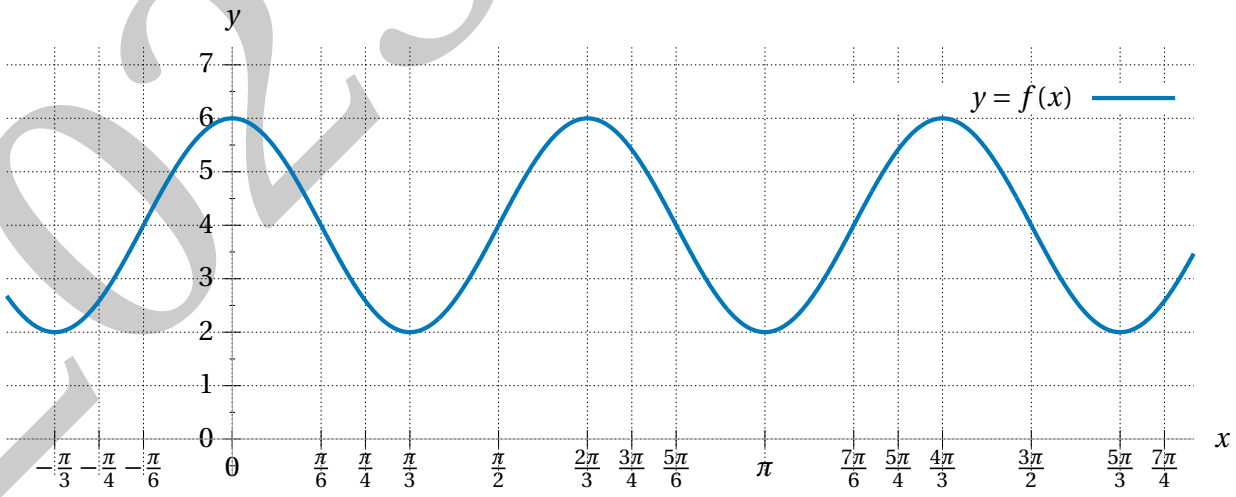
3. What is the smallest positive value of t such that $\tan(t) = 1$?

4. What values might $\cos(t)$ be if $\sin(t) = \frac{1}{2}$?

5. On the axes below, accurately sketch the graph of the function $3\sin\left(2x-\frac{\pi}{3}\right)$. Be sure that is is clear from your sketch what the period, amplitude, and phase shift of the function are, and exactly where the x-intercepts are located.



6. The graph of f, a transformation of the cosine function, is plotted below. What is a plausible formula for the function f? (CHALLENGE: The graph of f could *also* be regarded as a transformation of a sine function. What a plausible formula in this case?)



Math130 Trigonometry

Third Midterm Exam

Colorado Mesa University · 2025 Spring

NAME: _____

1. There is a unique line in the xy-plane that is inclined at an angle of 12.8° and that passes through the point $(88, 71)$. What's an equation for this line? Express the equation in the form $y = mx + b$.

2. What are the polar coordinates of the point in the xy-plane with rectangular coordinates $(17, 21)$?

3. A rain gutter should be installed along a roof at an slant/decline, usually called the *pitch* of the gutter. A common recommendation is that the gutter should drop by ½" for every 12' of roofing. What angle of declination (depression) does this recommendation correspond to? Be mindful of units!

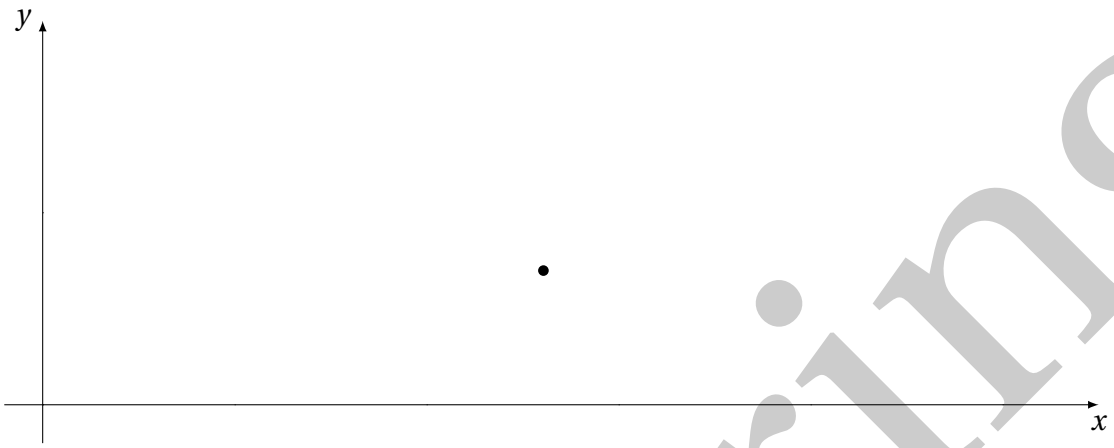
4. Note that $\frac{11\pi}{12} = 165°$. What is the exact value, expressed in terms of radicals if necessary, of $\cos\left(\frac{11\pi}{12}\right)$?

5. Suppose that except for the cosine button, every trigonometric function button on your calculator is broken. Needing to calculate a decimal approximation of the following expression, how do you rewrite the expression strictly in terms of cosine?

   $\sin^2(17°) + \sec(17°) + \tan(17°)$

6. Explain, as if explaining to a twelve-year-old, the procedure for converting an angle expressed as a decimal number of degrees to degrees/minutes/seconds.

7. Measuring in inches and degrees, accurate to within a tenth of an inch and 2°, what are the coordinates of the point (•) in the polar coordinate system defined by the x- and y-axis below.



8. Up to congruence, there is a unique triangle with side-lengths 2.5” and 3” and 5”. In the space below, using a ruler and protractor, *accurately* draw this triangle. PROTIP: Carefully plan your drawing.

9. A plane is flying over the ocean at a constant altitude along a straight path. Two ships on the ocean below are on the projected track of the plane. The captain of the ship furthest from the plane measures that the altitude of the plane is 27° above the horizon, but notices that the ship's radar is broken, so she can't tell how far away the plane is. She contacts the captain of the nearer ship over the radio, asking for the position of the plane, who reports back that, from his ship, the plane is ten miles directly away and has an altitude of 33° above the horizon.

   (a) How far is the plane from the further ship?

   (b) What is the altitude of the plane?