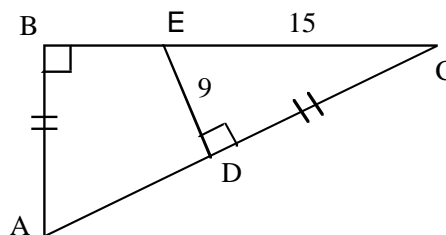


- 1) NC What are the x -intercepts of the graph $f(x) = 4 \sin^2 x - 3$ on the interval $[0, 2\pi]$?
- 2) If $f(x) = \sin(x)$. Let R be the relation we get by switching the coordinates of the graph of R .
 - a) Is R a function? Explain.
 - b) Sketch the graph of R .

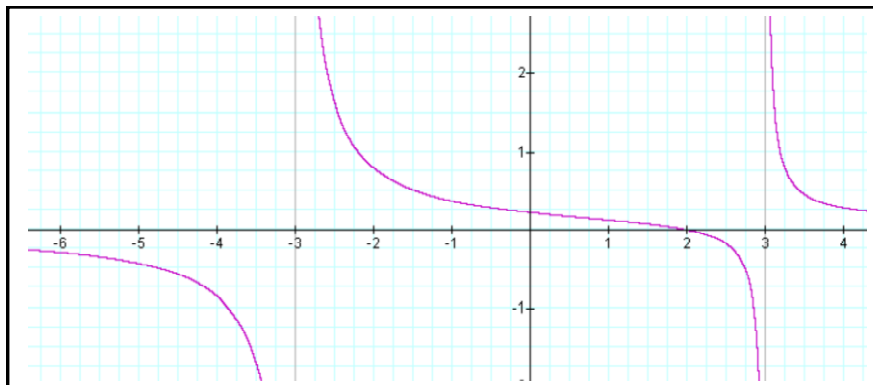
- 3) In the figure at the right (which is not drawn to scale), $\triangle ABC$ and $\triangle CDE$ are both right triangles. If $AB = CD$, find the perimeter and the area of $\triangle ABC$.



- 4) Sketch the following for $-2\pi \leq x \leq 2\pi$. Label all intercepts, maxima, and minima.
 - a. $y = 3 \sin(-x)$
 - b. $y = \left| 2 \sin\left(\frac{x}{2}\right) \right|$
 - c. $y = 4 \cos\left(\frac{4x}{3}\right)$

5) Derive the equations of rational functions for the following:

a) whose graph is shown if the y-intercept is $\left(0, \frac{1}{4}\right)$



b) That has a root of multiplicity one at 4, a root of multiplicity one at -2, vertical asymptotes at $x = 2$ and $x = -5$, a hole at when $x = -3$, and a horizontal asymptote of $y = \frac{7}{5}$.

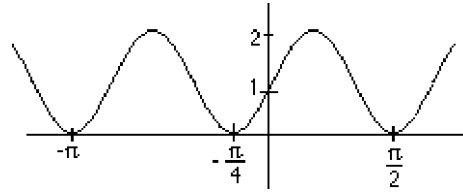
6)
$$f(x) = \frac{-2(x+6)^2(x+4)^2}{3x^2(x-4)^3}.$$

a. Write the equations of all of the asymptotes of $y = f(x)$.

b. Write the equations of all asymptotes for $y = \frac{1}{f(x)}$.

7)

 a. Given the graph of $y = f(x)$,

 State the range of: $y = 3f\left(x + \frac{\pi}{4}\right) - 2$

 b. Determine the coordinates (x, y) of the

 maxima for $y = 3f\left(x + \frac{\pi}{4}\right) - 2$.

- 8) Imagine there is a track that is a circle given by the equation $x^2 + y^2 = 100^2$. Robin and Shannon are running on the track. At $t = 0$, Robin is at $(100, 0)$ and Shannon is at $(-80, 60)$. Both are running counterclockwise, with Robin running at 4.5 ft/sec and Shannon at 3.2 ft/sec. Robin runs until he catches Shannon. Units of x and y are in feet.

What are the coordinates of the point at which they meet?

Note used F10 b) When they meet, Robin instantaneously (IMSA math students can do that) reverses himself and runs clockwise. What are the coordinates of the point where Robin and Shannon meet next?

- 9) Recall $x^2 + y^2 = 1$ is a circle of radius 1 centered at the origin. Do the following in the given order: 1) Replace x with $\frac{x}{3}$ and y with $\frac{y}{5}$ then, 2) Replace x with $(x-2)$ and y with $(y+1)$.

a) State the resulting equation.

b) Describe the transformations you performed. That is, describe how the graph has changed geometrically.

c) State the vertices (all four) and the center of the resulting ellipse.

You may want to examine the graph to help you, but it is not required you turn it in.

10) A new oil field has just begun producing oil. The first oil that is removed is the easiest to get out, and in fact for this field it is determined that 12% of the oil that remains can be removed each year. If the company continues to remove 12 % of what remains, when will the first time be when there is less than 12% of the original amount of oil remaining? Give your answer to one decimal place in years.

11) Find A and B such that $\frac{1}{k(k+1)} = \frac{A}{k} + \frac{B}{k+1}$.

12) Let $z = 1 + \sqrt{3}i$.

a) When z is graphed in the complex plane, what angle does it make with the positive real axis?

b) What angles do z^2 , z^3 , and z^4 make with the positive real axis? You may use your TI-89 to find the powers of z .

c) For what values of n does z^n make an angle measure of 0° with the positive real axis? Justify your answer.

13) The EFISCEN wood product model classifies wood products according to their life span. A study found that the percent of wood remaining in the group with longest life span is given by the function

$$P(t) = \frac{100.3952}{1 + 0.0316 \cdot e^{0.0581t}}$$

where t is in years and P is the percent that remains. Give your answer to one decimal place.

a) Graph this model on your computer. Your graph should include a title and your axes labeled. Print your graph and attach your plot to your answer sheets.

b) What is the percentage of remaining wood products after 20 years? Find this value algebraically and mark the point on the graph, labeled electronically.

c) What is a reasonable domain and range of this function? Explain.

14. a) Using your computer, make a graph of $f(x) = \cos(x)$ and its reciprocal on the same grid using the interval $[-2\pi, 2\pi]$. Graph the asymptotes you find as dashed lines. Attach your graph to your answer sheets.
- b) Change the amplitude of f to explore the effect it has on the reciprocal. No need to write anything down here, this just gets you ready for the next question.
- c) Explore the graph of the reciprocal of $f(x) = a\cos(bx)$. Determine a rule for 1) the asymptotes and 2) the coordinates of the relative minimums and maximums of the graph, that is, what looks like the vertices of the U shapes you see. Your answers should be in terms of a and/or b .

Winplot directions for this exploration:

1. Enter your function as a 'user function' and give it a 2 letter name like fa , for example.
2. Under Equation, Explicit, enter ' $fa(x)$ '.
3. Enter a second equation under Equation, Explicit, $\frac{1}{fa(x)}$.
4. Under Anim menu, set A to 1 and B to 1 to see your graph from part (a).
5. Explore by moving the sliders for A and B.

Note: You may want to change the view, grid to some convenient multiple of π for the x -axis.

- d) Justify the rules you found in part c with an analytical argument from your understanding of rational functions and the basic graph of sinusoidal curves.