

Print and sign a brief statement stating this is your work and you used no other resource:

Name (sign): \_\_\_\_\_

Name (print): \_\_\_\_\_

Student Number: \_\_\_\_\_

Instructor's Name: \_\_\_\_\_

Class Time: \_\_\_\_\_

1. Determine the value of  $x$  that satisfies each equation below. Print your answer in the box provided, and your answer should be an exact answer. (No decimal approximations.)

(a)  $3x = 8x^2 - 3$ .

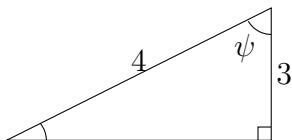
(b)  $5(2^x) = 4(5^x)$ .

(c)  $\ln(3x + 1) = 2 + \ln(2x)$ .

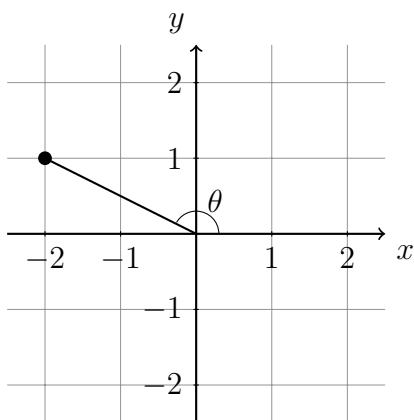
(d)  $\cos(3x + 1) = \frac{\sqrt{3}}{2}$  where  $x$  is a negative number and is the closest possible value to zero.

2. Determine the values of the expression in each box below based on the given equation. Print your answer in the box provided.

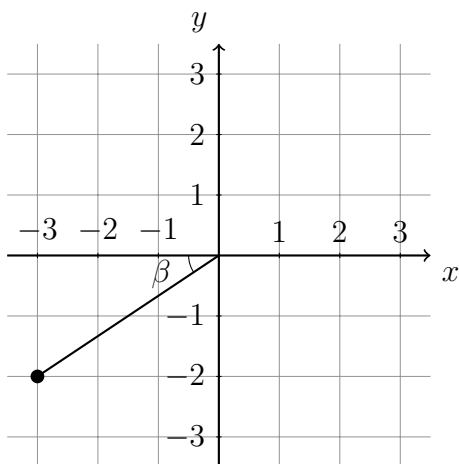
(a) Determine the exact value of  $\tan(\psi)$ . (No decimal approximations.)



(b) Determine the value of  $\theta$  in the plot below. If you use a calculator then your estimate should be within 0.01 radians of the true value.



(c) Determine the value of  $\beta$  in the plot below. If you use a calculator then your estimate should be within 0.01 radians of the true value.



3. For each scenario below circle the phrase that best describes the **kind** of function that will best approximate the phenomena described.

(a) The amount of radioactive material present after a given time period.

Linear  
Function

Quadratic  
Function

Exponential  
Function

Trigonometric  
Function

(b) The height of the sea level at a beach.

Linear  
Function

Quadratic  
Function

Exponential  
Function

Trigonometric  
Function

(c) The area of a square as a function of the length of its sides.

Linear  
Function

Quadratic  
Function

Exponential  
Function

Trigonometric  
Function

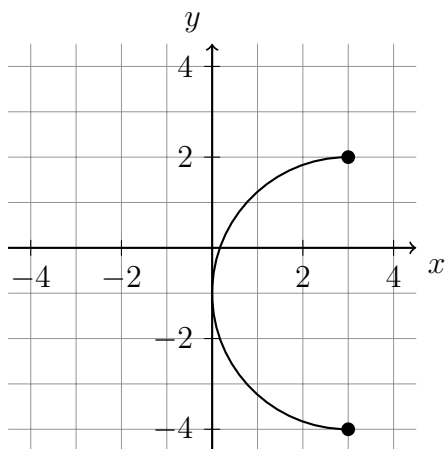
4. Twenty kilograms of a radioactive material is placed in an isolated location. After ten years eighteen kilograms of the material remains. Use this information to answer the questions below.

(a) How much material will remain after fifteen years?

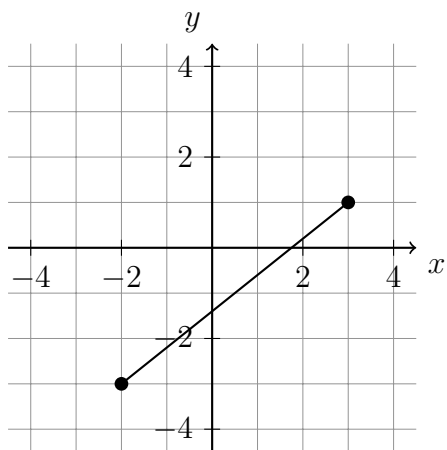
(b) It will require eight kilograms of the material to turn a human into a weird spider like monster. What is the longest that a super villain can wait and still use the site to create a spider like monster?

5. The graphs of a number of relationships are given below. For each graph determine an equation representing the relationship. Also, state whether or not the relationship is a function. If it is a function determine the range and domain of the function.

(a) (The curve in the figure is a semi-circle.)



(b)



6. A circular pie has a diameter of 25cm. It is cut into slices, and each slice has an angle of  $\frac{\pi}{8}$  radians.

(a) How many slices will the pie have?

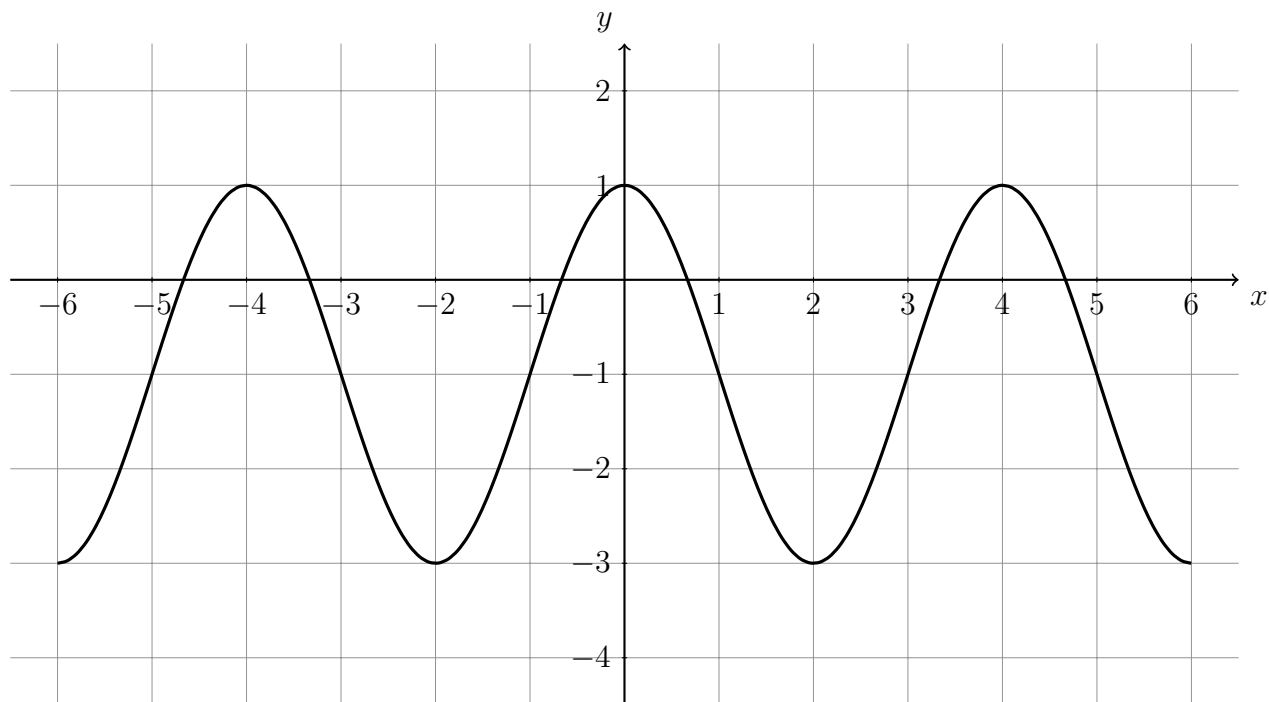
(b) What is the area of each slice?

(c) If you wanted to have a pie cut into 6 slices and each slice has an area of  $8 \text{ cm}^2$  then what angle (in radians) and radius would you need?

7. The graph of a function,

$$f(x) = A \sin(bx + c) + d,$$

is shown in the figure below. Determine the values for all of the constants,  $A$ ,  $b$ ,  $c$ , and  $d$ .





8. You have been asked to help design a channel taking water from a lake into a reservoir. The channel must have a rectangular cross section with a fixed depth and width throughout its entire length. The bigger the cross section, the more the channel will cost. In fact, the total cost of building the channel will be \$30,000 dollars per meter of depth and \$10,000 per meter of width of its cross section, and the government has budgeted a total of \$100,000 to construct the channel. The government wants you to use this money to build a channel which will maximize the rate at which water flows through the channel (which is proportional to the cross sectional area of the channel). What is the depth and width that will accomplish this?

9. A forester wants to estimate the height of a tree without climbing the tree. The tree is on level ground, and the forester stands 20m from the base of the tree and measures the angle of elevation from the ground to the top of the tree. If the angle is 25 degrees determine the height of the tree.

10. The vertical wind shear relates the wind velocity,  $v$ , with the height,  $h$ , above the ground. In a given location the wind shear is given by

$$\frac{v}{v_0} = \left( \frac{h}{h_0} \right)^{0.23},$$

where  $v$  and  $h$  are the velocity of the wind and corresponding height at one location, and  $v_0$  and  $h_0$  are the velocity of the wind and corresponding height at another location. If the velocity of the wind is 4 m/sec. at a height of 5 m determine the equation for the height given the velocity. Determine the inverse of your function and briefly explain what it means.

Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): \_\_\_\_\_ Instructor (print): \_\_\_\_\_ Time: \_\_\_\_\_