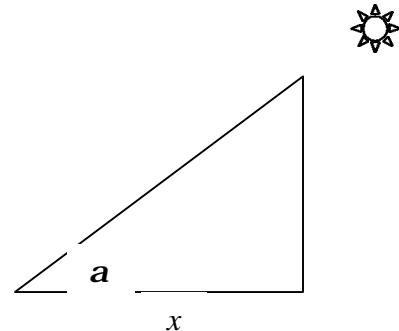
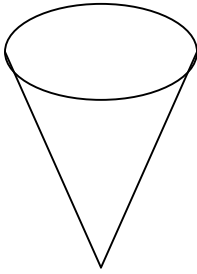


1. Let  $y = x^2 + 4x + 1$ .
  - a) Find the average rate of change of  $y$  with respect to  $x$  over the interval  $[1, 2]$ .
  - b) Find the instantaneous rate of change of  $y$  with respect to  $x$  at  $x = 1$ .
  
2. Use a definition of a derivative to find the derivative of  $y = x^2 + 7x + 4$ .
  
3. Find  $dy/dx$ 
  - A.  $y = -3x^5 + 6x - 8$
  - B.  $y = -5x^{-4} + \sqrt{x}$
  - C.  $y = \frac{2x - 5}{7x + 3}$
  - D.  $y = x^4 \sin x$
  - E.  $y = 3x - 5 \csc x + \cot x$
  - F.  $y = \cos^3 2x$
  
4. Show that  $y = \tan x$  is a solution of  $y'' - y' \tan x - y \sec^2 x = 0$ .
  
5. Use implicit differentiation to find  $y'$ .  
 $4y - xy^2 = x^3$
  
6. A 40 foot flagpole casts a shadow that changes with the angle of elevation of the sun. Let  $x$  represent the length of the shadow and  $a$  the angle of elevation of the sun. Find the rate at which the length of the shadow is changing with respect to  $a$  when  $a = 45^\circ$ . Express your answer in units of feet/degree.



7. Given that  $x^3y^3 - 27 = 0$  and  $y' = -\frac{y}{x}$ , find  $y''$ .
8. A ladder 25 feet long rests against a wall and the lower end is being pulled out, directly away from the wall, at 6 feet per minute. At what rate is the top of the ladder descending at the instant when the lower end is 7 feet from the wall?
9. A conical water tank with vertex down has a radius of 6 feet at the top and is 24 feet high. If water flows into the tank at a rate of 20 cubic feet /minute, how fast is the depth of the water increasing when the water is 10 feet high?



- 10 Find the x-coordinate of the point on the graph of  $y = x^2$  where the tangent line is parallel to the secant line that cuts the curve at  $x = -1$  and  $x = 3$ .
11. Find the equation of the tangent line to  $y = x \sin x$  at  $x = \frac{\pi}{2}$ .
12. Use an appropriate local linear approximation to estimate the value of  $(2.08)^3$
13. Find formulas for  $dy$  and  $\Delta y$ .

$$y = x^2 + 3x$$

a)  $dy =$  \_\_\_\_\_

b)  $\Delta y =$   
\_\_\_\_\_

14. The side of a cube is measured to be 8 cm., with a possible error of  $\pm 0.5$  cm. Use differentials to estimate the error in the calculated volume. Then estimate the percentage errors in the side and volume.

