

1.) Differentiate each of the following functions. DO NOT SIMPLIFY ANSWERS.

a.)  $y = \pi + (5x + 1)^{-4}$

b.)  $f(x) = \sec x \cdot \tan 3x$

c.)  $g(x) = \sin(\cos^3(x^4))$

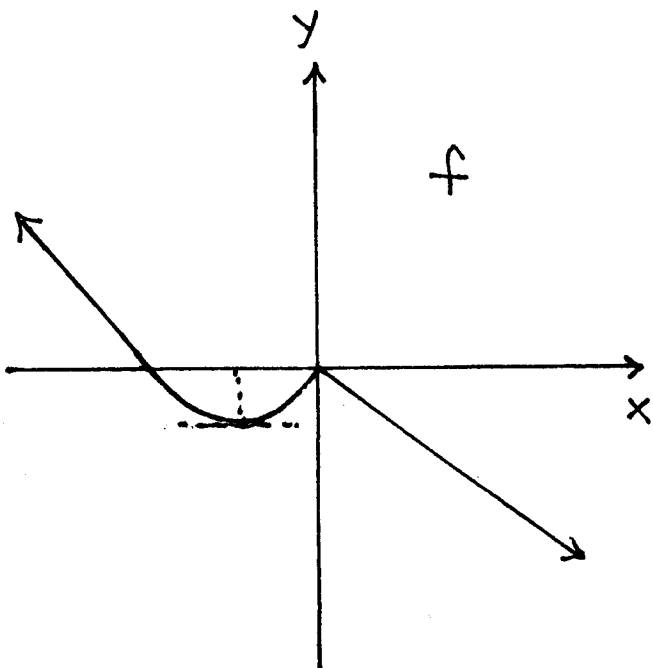
d.)  $y = x^5 + 8^{-x^2}$

e.)  $y = \frac{4 - \ln x}{10 + \log_2(3x + 7)}$

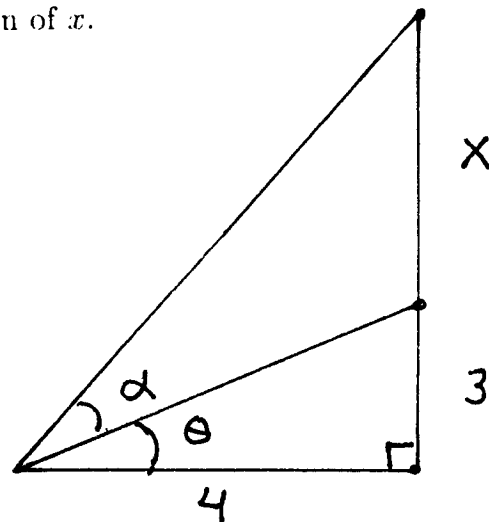
f.)  $y = x^{\ln x}$

2.) Use  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  to differentiate the function  $f(x) = \frac{x+7}{3-x}$ .

3.) Sketch the graph of  $f'$  using the graph of  $f$ .



- 7.) Consider the given diagram. Write  $\alpha$  as a function of  $x$ .



- 8.) Let  $f(x) = x + 5 \arctan(1/x)$ . Solve  $f'(x) = 0$  for  $x$ .

9.) Differentiate the following function and SIMPLIFY your answer as much as possible :  $f(x) = (x - 3)\sqrt{6x - x^2} + 9 \arcsin\left(\frac{x - 3}{3}\right)$ .

8.) A 15-foot ladder is leaning against a wall. If the base of the ladder is pushed toward the wall at the rate of 2 ft./sec., at what rate is the top of the ladder moving up the wall when the base of the ladder is 6 ft. from the wall ?

9.) Use differentials to estimate the value of  $\sqrt{96}$ .

10.) The radius and height of a cylinder are both equal to  $x$  so that the volume of the cylinder is given by  $V = \pi x^3$ . Assume that  $x$  is measured with an absolute percentage error of at most 3%. Use a differential to estimate the maximum absolute percentage error in computing the cylinder's volume.

The following EXTRA CREDIT PROBLEM is worth      points. This problem is OPTIONAL.

1.) A beetle crawls along a thin rod on the  $x$ -axis from  $x = 0$  in. to  $x = 16$  in. at the rate of 3 in./min. The temperature of the rod at point  $x$  is  $40 + 12\sqrt{x}$  degrees Fahrenheit ( $^{\circ}$  F). At what rate ( $^{\circ}$  F per min.) is the temperature of the rod under the beetle changing when the beetle is at  $x = 9$  in. ?