

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper. Do **NOT** write on this page. Calculators can be used for graphing and calculating only. Give exact answers when possible.

- Find  $\frac{dy}{dt}$  if  $y = (t^2 + 3t + 2)/(t + 1)$
- If  $g(s) = 2^s + \ln s + \arcsin s + \tan s - \pi^3$  find  $g'$
- Find  $w'$  if  $w = 2 \sin x + \sin(2x) + \sin(x^2) + \sin^2 x + \sin(\sin x)$
- Find  $y'$  implicitly, if  $x^3 + y^3 - 4x^2y = 1$
- Using L'Hopital, find

$$\lim_{x \rightarrow 0} \frac{\sin(2x)}{\tan(5x)}$$

- Find the equation of the tangent line to  $f(x) = \cos x$  at  $x = \pi/3$  and find where it intersects the x-axis.
- Suppose we are given the data in the table about the functions  $f$  and  $g$  and their derivatives. Find the following values:

$x$	1	2	3	4
$f(x)$	3	2	1	4
$f'(x)$	1	4	2	3
$g(x)$	2	1	4	3
$g'(x)$	4	2	3	1

- $h'(4)$  if  $h(x) = f(g(x))$
  - $h'(4)$  if  $h(x) = g(f(x))$
  - $h'(4)$  if  $h(x) = f(x)g(x)$
  - $h'(4)$  if  $h(x) = f(x)/g(x)$
  - $h'(4)$  if  $h(x) = f(g(f(x)))$
- Find the local linearization of  $\sqrt{x}$  near  $x = 1$ . Use your approximation to estimate  $\sqrt{.96}$ . Find  $\sqrt{.96}$  exactly, and determine the percent error of your estimate. [The percent error is the absolute value of the error divided by the exact value (with the answer written as a percentage).]
  - A spherical cell is growing at a constant rate of  $400\mu m^3/\text{day}$  ( $1\mu m = 10^{-6}m$ ). At what rate is its radius increasing when the radius is  $10\mu m$ ?
  - A radio navigation system used by aircraft give a cockpit readout of the distance,  $s$ , in miles, between a fixed ground station and the aircraft. The system also gives a readout of the instantaneous rate of change,  $ds/dt$ , of this distance in miles/hour. An aircraft on a straight flight path at a constant altitude of 10,560 feet (2 miles) has passed directly over the ground station and is now flying away from it. What is the speed of this aircraft along its constant altitude flight path when the cockpit readouts are  $s = 4.6$  miles and  $ds/dt = 210$  miles/hour. As part of your solution, draw a picture with at least labels for the aircraft, ground station and the distance  $s$ .