Directions: Show **ALL** work for credit; Give **EXACT** answers when possible; Start each problem on a **SEPARATE** page; Use only **ONE** side of each page; Be neat; Leave margins on the left and top for the **STAPLE**; Calculators can be used for graphing and calculating only; Nothing written on this page will be graded;

1. Let $f(x)$ and $g(x)$ be two functions. Values of $f(x)$, $f'(x)$, $g(x)$ and $g'(x)$ are given in the table below. Use the information to find and simplify:

   a. $G'(0)$ if $G(x) = f(x)/g(x)$
   b. $H'(1)$ if $H(x) = e^{f(x)} + \pi^3$
   c. $J'(1)$ if $J(x) = [f(x)]^2$
   d. $K'(0)$ if $K(x) = f(g(x))$

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
0	1	-1	2	3
1	-1	2	4	0
2	7	3	11	0.5

2. Consider the equation $x^2 - 2x + y^2 - xy = 3$ Find dy/dx by implicit differentiation and find the equation of the tangent to this curve at the point $(2, -1)$

3. Find the derivative of each function.

   (a) $\cos(\sqrt{1 + \sin(x^2)})$
   (b) $(\tan(2x) + \arctan(3x))^{45}(2^x + x^2)^{-5}$

4. Graphical Problems.

   (a) The figure below (left) shows the graphs of f, f' and f''. Indentify each curve and explain your choices.
   (b) The figure below (right) shows the graph of g. Which is bigger $g(1)$ or $g(2)$? Which is bigger $g'(1)$ or $g'(2)$? Which is bigger $g''(1)$ or $g''(2)$?
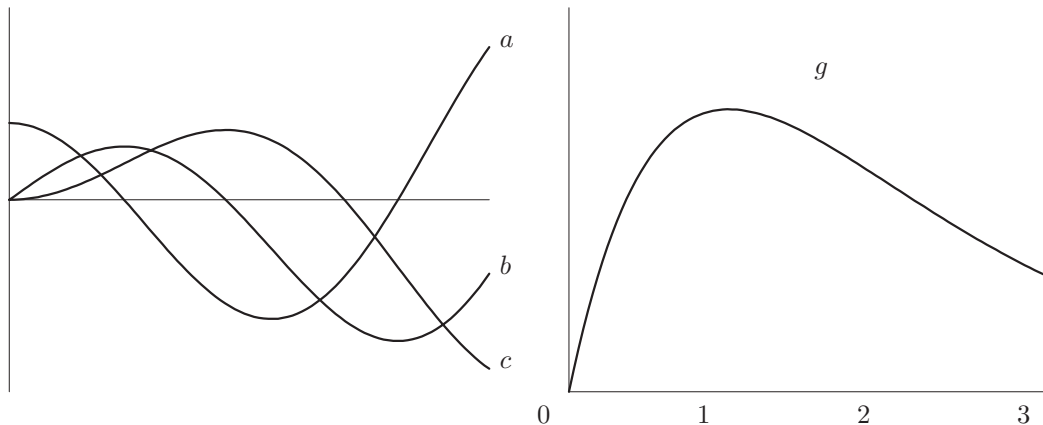
5. A particle moves according to a law of motion $s = t^3 - 9t^2 + 15t + 10$, $t \geq 0$, where t is measured in seconds and s in meters.

   (a) Find the velocity at time t.
   (b) Find the velocity after 3 seconds.
   (c) When is the particle at rest?
   (d) When is the particle moving in the positive direction?
   (e) Find the total distance traveled during the first 8 seconds.
   (f) Draw a diagram to illustrate the motion of the particle.