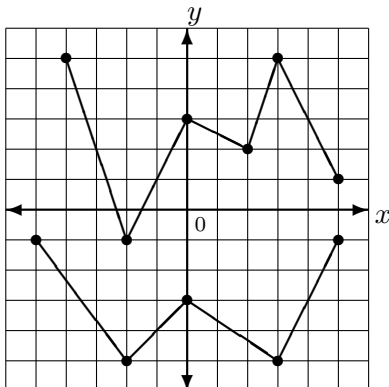


1. The graphs of functions  $f$  and  $g$  are shown below. ( $f$  is the top graph and  $g$  is the bottom graph)



- (a) Let  $F(x) = f(x) + g(x)$ . Compute  $F'(-\frac{7}{2})$ .
- (b) Let  $G(x) = f(x)g(x)$ . Compute  $G'(-1)$ .
- (c) Let  $H(x) = \frac{f(x)}{g(x)}$ . Compute  $H'(4)$ .
- (d) Let  $K(x) = g(f(x))$ . Compute  $K'(-3)$ .
2. Find the derivative of each function. You do not need to simplify.

- (a)  $f(x) = \sqrt[5]{x^3} + \frac{7}{3x^9} - 18x^2 + \frac{9x^4}{5} + \frac{4}{\sqrt{x}}$
- (b)  $g(x) = (5x^3 - 6x^2 + 9)^5 (8x^4 - 7x^3 + 2x)^3$
- (c)  $f(x) = x^3 \sin x^4 + \cos^4 x^2$
- (d)  $g(x) = \sqrt[3]{\frac{4x^3 - 7x + 9}{5x^2 - 8x + 2}}$
- (e)  $f(x) = \cos(\sec(x^4 + 7))$
- (f)  $g(x) = [x^7 + (x^2 - 1)^5]^{-2}$

3. Use implicit differentiation to find the **slope** of the line tangent to the curve

$$x^2 + xy^2 + y^3 = 7$$

at the point  $(2, 1)$ .

4. Use implicit differentiation to find  $y'$  for the following equation.

$$3x^2 + x \sin y = 4y \tan x + 5$$

5. Find the **equation** of the line tangent to the graph of  $f(x) = \frac{3}{2x^2 - 1}$  at the point  $(1, 3)$ .
6. A particle moves according to the distance function

$$s(t) = 2t^3 - 15t^2 + 36t + 2$$

- (a) Find the velocity at time  $t$ .
- (b) Find the acceleration at time  $t$ .
- (c) When is the particle moving in a positive direction?
- (d) (SET UP ONLY) Find the total distance travelled in the first 9 seconds.
- (e) When is the particle speeding up?

7. A man walks along a straight path at a speed of 4 feet per second. A searchlight is located on the ground 20 feet from the path and is kept focused on the man. At what rate is the searchlight rotating when the man is 15 feet from the point on the path closest to the searchlight?

8. If  $f(x) = \sin^2 x - \cos x$ , find  $f''(\frac{5\pi}{6})$ .

9. Determine the  $x$ -values for which the slope of the tangent line to  $f(x) = \cos 2x - 2 \sin x$  is horizontal.

## ANSWERS

1. (a)  $-\frac{13}{3}$   
 (b)  $-7$   
 (c)  $0$   
 (d)  $2$
2. (a)  $f'(x) = \frac{3}{5}x^{-2/5} - 21x^{-10} - 36x + \frac{36}{5}x^3 - 2x^{-3/2}$   
 (b)  $g'(x) = (5x^3 - 6x^2 + 9)^5(3)(8x^4 - 7x^3 + 2x)^2(32x^3 - 21x^2 + 2) + (8x^4 - 7x^3 + 2x)^3(5)(5x^3 - 6x^2 + 9)^4(15x^2 - 12x)$   
 (c)  $f'(x) = x^3(\cos x^4)(4x^3) + 3x^2 \sin x^4 + 4(\cos^3 x^2)(-\sin x^2)(2x)$   
 (d)  $g'(x) = \frac{1}{3} \left( \frac{4x^3 - 7x + 9}{5x^2 - 8x + 2} \right)^{-2/3} \frac{(5x^2 - 8x + 2)(12x^2 - 7) - (4x^3 - 7x + 9)(10x - 8)}{(5x^2 - 8x + 2)^2}$   
 (e)  $f'(x) = [-\sin(\sec(x^4 + 7))] [\sec(x^4 + 7) \tan(x^4 + 7)] (4x^3)$   
 (f)  $g'(x) = -2 [x^7 + (x^2 - 1)^5]^{-3} [7x^6 + 5(x^2 - 1)^4(2x)]$
3.  $m = y' = -\frac{5}{7}$
4.  $y' = \frac{4y \sec^2 x - 6x - \sin y}{x \cos y - 4 \tan x}$
5.  $y = -12x + 15$
6. (a)  $v(t) = s'(t) = 6t^2 - 30t + 36$   
 (b)  $a(t) = v'(t) = s''(t) = 12t - 30$   
 (c)  $0 < t < 2; t > 3$   
 (d) distance =  $|s(9) - s(3)| + |s(3) - s(2)| + |s(2) - s(0)|$   
 (e)  $2 < t < 2.5; t > 3$
7.  $\frac{16}{125}$  rad/sec
8.  $f''\left(\frac{5\pi}{6}\right) = \frac{2 - \sqrt{3}}{2}$
9.  $x = \frac{\pi}{2} + 2n\pi, x = \frac{3\pi}{2} + 2n\pi, x = \frac{7\pi}{6} + 2n\pi, x = \frac{11\pi}{6} + 2n\pi$  (Note: first two solutions can be combined to  $x = \frac{\pi}{2} + n\pi$ )