

Show all work needed to complete a problem on these pages.

(1 - 4) For each of the following find $\frac{dy}{dx}$.

1. $y = \frac{(7x + 3)^5}{(x^2 + 3x)^4}$

2. $y = \cos^2(3x)$

3. $y = \sqrt[3]{7x^2 - 3x + 1}$

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

5. Find the equation of the tangent line to $2x^3 - x^2y + y^3 - 1 = 0$ at the point (2, -3).

6. Use Newton's method to find $\sqrt[5]{30}$ accurate to 0.0000001 by solving $x^5 - 30 = 0$. Start with $x_0 = 2$ since $2^5 = 32$. Fill in the equation used and the chart showing all your intermediate values for x_i below.

Equation used: $x_{n+1} =$

x_0	
x_1	
x_2	
x_3	
x_4	

7. In Flatland by Edwin A. Abbott, everything is two-dimensional. A young circle is growing at a rate of $\pi \text{ cm}^2/\text{year}$. How fast is his diameter changing when he is 10 cm across (in diameter)?

8. A light is at the top of a 20 ft pole. A man 6 ft tall walks away from the light at a steady rate of 4 ft/sec.

a. At what rate is the length of his shadow increasing when he is 25 ft away from the light?

b. At what rate is the tip of his shadow moving when he is 25 ft away from the light?

9. Find the coordinates where the absolute maximum and absolute minimum occur for $f(x) = 1 - x^{2/3}$ on $[-1, 8]$. Prove your answer by using the first derivative and finding all local extrema and comparing them. Show all of this even if you are capable of doing it in your head.

10. Suppose the functions f and g and their derivatives with respect to x have the following values at $x=1$ and $x=2$:

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

a. Find the derivative of $f(g(x))$ with respect to x at $x = 1$.

b. Find the derivative of $g^3(x)$ with respect to x at $x = 2$.

c. Find the derivative of $f(x) \cdot g(x)$ with respect to x at $x = 1$.

11. The radius of a circular disk is measured to be 10 inches with a maximum error of measurement to be ± 0.07 inches. Use differentials to estimate:

a. the maximum error in the calculated area of one side.

b. the percentage error in the calculated area of one side.

12. Match the following functions whose derivatives are given with one of the graphs.

(i.) $f'(x) = \frac{x(x+4)}{x+2}$ — (ii.) $f'(x) = \frac{x^2(x+4)}{(x+2)^2}$ — (iii.) $f'(x) = \frac{x(x+4)^2}{x+2}$ —



