

## Techniques of Differentiation - Homework

For the following functions, find  $f'(x)$  and  $f'(c)$  at the indicated value of  $c$ .

1)  $f(x) = x^2 - 6x + 1$     $c = 0$       2)  $f(x) = \frac{1}{x} - \frac{3}{x^2} + \frac{4}{x^3}$     $c = 1$       3)  $f(x) = 3\sqrt{x} - \frac{1}{\sqrt[3]{x}}$     $c = 1$

For the following functions, find the derivative using the power rule.

4)  $y = \frac{8}{3x^2}$

5)  $y = \frac{-9}{(3x^2)^3}$

6)  $y = \frac{6x^{3/2}}{x}$

7)  $y = \frac{4x^2 - 5x + 6}{3}$

8)  $y = \frac{x^2 - 6x + 2}{2x}$

9)  $y = \frac{x^3 + 8}{x + 2}$

10)  $y = x^4 - \frac{3}{2}x^3 + 5x^2 - 6x - 2$

11)  $y = \frac{x^3 - 3x^2 + 10x - 5}{x^2}$

12)  $y = (x^2 + 4x)(2x - 1)$

13)  $y = (x - 2)^3$

14)  $y = \sqrt[3]{x} - \sqrt[3]{x^2}$

15)  $y = \frac{(x^2 - x + 2)^2}{x}$

For the following functions, find the derivatives.

16)  $y = (x^2 - 4x - 6)(x^3 - 5x^2 - 3x)$    17)  $y = \frac{3x - 2}{2x + 3}$

18)  $y = \frac{x^2 - 4x - 2}{x^2 - 1}$

19)  $y = \frac{x-1}{\sqrt{x}}$

20)  $y = \frac{x^2 - x + 1}{\sqrt[3]{x}}$

21)  $y = \left(\frac{x-3}{x+4}\right)(3x-2)$

22)  $y = \frac{x-1}{x^2 + 2x + 2}$

23)  $y = \frac{x^2 + k^2}{x^2 - k^2}$ ,  $k$  is a constant

24)  $y = \frac{x^2 - k^2}{x^2 + k^2}$ ,  $k$  a constant

Find an equation of the tangent line to the graph of  $f$  at the indicated point and then use your calculator to confirm the results.

25)  $f(x) = \frac{x^2}{x-1}$  at  $(2,4)$

26)  $f(x) = (x-2)(x^2 - 3x - 1)$  at  $(-1,-9)$

27)  $f(x) = \frac{x^2 - 4x + 2}{2x - 1}$  at  $\left(2, -\frac{2}{3}\right)$

28)  $y = \left(\frac{x+3}{x+1}\right)(4x+1)$  at  $\left(-\frac{1}{2}, -5\right)$

Determine the point(s) at which the graph of the following function has a horizontal tangent.

$$29) f(x) = \frac{x^2}{x^2 - 4}$$

$$30) f(x) = \frac{4x}{x^2 + 4}$$

Use the chart to find  $h'(4)$

$f(4)$	$f'(4)$	$g(4)$	$g'(4)$
-8	3	$3\pi$	4

$$31) h(x) = 5f(x) - \frac{2}{3}g(x)$$

$$32) h(x) = 3 + 8f(x)$$

$$33) h(x) = f(x)g(x)$$

$$34) h(x) = \frac{f(x)}{g(x)}$$

$$35) h(x) = \frac{g(x)}{f(x)}$$

$$36) h(x) = \frac{f(x) + 2}{-3g(x)}$$

For each of the following, find  $f''(x)$ .

$$37) f(x) = \frac{x^3 - 3x^2 - 4x - 1}{2x}$$

$$38) f(x) = \frac{x}{x - 4}$$

$$39) f(x) = \sqrt{x} - 4\sqrt[3]{x} + \frac{6}{5\sqrt[4]{x}}$$

40) Find an equation of the line that is tangent to  $f(x) = x^2 - 6x + 7$  and

a) parallel to the line  $y = 2x + 4$

b) perpendicular to the line  $y = 2x + 4$