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) $f(x) = \dfrac{1}{x} - \dfrac{3}{x^2} + \dfrac{4}{x^3}$ $c = 1$

3) $f(x) = 3\sqrt{x} - \dfrac{1}{\sqrt[3]{x}}$ $c = 1$

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

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

5) $y = \dfrac{-9}{\left(3x^2\right)^3}$

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

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

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

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

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

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

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

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

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

15) $y = \dfrac{\left(x^2 - x + 2\right)^2}{x}$

For the following functions, find the derivatives.

16) $y = \left(x^2 - 4x - 6\right)\left(x^3 - 5x^2 - 3x\right)$

17) $y = \dfrac{3x - 2}{2x + 3}$

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

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

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

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

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

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

24) $y = \dfrac{x^2 - k^2}{x^2 + k^2}$, 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) $f(x) = \dfrac{x^2}{x-1}$ at $(2,4)$

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

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

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

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

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

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

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

$f(4)$	$f'(4)$	$g(4)$	$g'(4)$
-8	3	3π	4

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

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

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

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

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

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

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

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

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

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

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 $y = 2x + 4$