3.3a

6. $h(x) = (x-2)(2x+3) = 2x^2 - x - 6$
$h'(x) = 2 \cdot 2x^1 - 1 - 0 = 4x$

7. $f(t) = \frac{1}{4}(t^4+8) = \frac{1}{4}t^4 + 2$

$f'(t) = 4 \cdot \frac{1}{4}t^3 + 0 = t^3$

8. $f(t) = \frac{1}{2}t^6 - 3t^4 + t$

$f'(t) = 6 \cdot \frac{1}{2}t^5 - 4 \cdot 3t^3 + 1 = 3t^5 - 12t^3 + 1$

9. $V(r) = \frac{4}{3}\pi r^3$

$V'(r) = 3 \cdot \frac{4}{3}\pi r^2 = 4\pi r^2$

10. $R(t) = 5t^{\frac{-3}{5}}$

$R'(t) = -\frac{3}{5}(5)t^{\frac{-8}{5}} = -3t^{\frac{-8}{5}}$

11. $y(t) = 6t^{-9}$

$y'(t) = -9(6)t^{-10} = -54t^{-10}$

12. $R(x) = \frac{\sqrt{10}}{x^7} = \sqrt{10}\,x^{-7}$

$R'(x) = -7\sqrt{10}\,x^{-8}$

13. $F(x) = (\frac{1}{2}x^5) = \frac{1}{32}x^5$

$F'(x) = 5(\frac{1}{32})x^4 = \frac{5}{32}x^4$

14. $f(t) = \sqrt{t} - \frac{1}{\sqrt{t}} = t^{\frac{1}{2}} - t^{\frac{-1}{2}}$

$f'(t) = \frac{1}{2}t^{\frac{-1}{2}} - (\frac{-1}{2})t^{\frac{-3}{2}} = \frac{1}{2}t^{\frac{-1}{2}} + \frac{1}{2}t^{\frac{-3}{2}}$

15. $A(s) = \frac{-12}{s^5} = -12s^{-5}$

$A'(s) = -5(-12)s^{-6} = 60s^{-6}$

16. $B(y) = cy^{-6}$ [NOTE: $y$ is the variable, $c$ is constant]

$B'(y) = -6(c)y^{-7} = -6cy^{-7}$

17. $y = 4\pi^2$

$y' = 0$

18. $g(u) = \sqrt{2}\,u + \sqrt{3u} = \sqrt{2}\,u + \sqrt{3}\cdot\sqrt{u} = \sqrt{2}\,u + \sqrt{3}\,u^{\frac{1}{2}}$

$g'(u) = \sqrt{2}\,(1) + \frac{1}{2}\sqrt{3}\,u^{\frac{-1}{2}} = \sqrt{2} + \frac{\sqrt{3}}{2}u^{\frac{-1}{2}}$

19. $u = \sqrt[5]{t} + 4\sqrt{t^5} = t^{\frac{1}{5}} + 4t^{\frac{5}{2}}$

$u' = \frac{1}{5}t^{\frac{-4}{5}} + \frac{5}{2}(4)t^{\frac{3}{2}} = \frac{1}{5}t^{\frac{-4}{5}} + 10t^{\frac{3}{2}}$

20. $v = \left(\sqrt{x} + \frac{1}{\sqrt[3]{x}}\right)^2 = \left(x^{\frac{1}{2}} + x^{\frac{-1}{3}}\right)^2 = \left(x^{\frac{1}{2}} + x^{\frac{-1}{3}}\right)\left(x^{\frac{1}{2}} + x^{\frac{-1}{3}}\right)$

$= x + x^{\frac{1}{6}} + x^{\frac{1}{6}} + x^{\frac{-2}{3}}$

$= x + 2x^{\frac{1}{6}} + x^{\frac{-2}{3}}$

$v' = 1 + \frac{1}{6}(2)x^{\frac{-5}{6}} + (\frac{-2}{3})x^{\frac{-5}{3}} = 1 + \frac{1}{3}x^{\frac{-5}{6}} - \frac{2}{3}x^{\frac{-5}{3}}$

57. $f(x) = x^4 - 3x^3 + 16x$

$f'(x) = 4x^3 - 3(3)x^2 + 16(1) = 4x^3 - 9x^2 + 16$

$f''(x) = 3(4)x^2 - 2(9)x^1 + 0 = 12x^2 - 18x$

58. $G(r) = \sqrt{r} + \sqrt[3]{r} = r^{\frac{1}{2}} + r^{\frac{1}{3}}$

$G'(r) = \frac{1}{2}r^{\frac{-1}{2}} + \frac{1}{3}r^{\frac{-2}{3}}$

$G''(r) = \frac{-1}{2}\left(\frac{1}{2}\right)r^{\frac{-3}{2}} + \left(\frac{-2}{3}\right)\left(\frac{1}{3}\right)r^{\frac{-5}{3}} = \frac{-1}{4}r^{\frac{-3}{2}} - \frac{2}{9}r^{\frac{-5}{3}}$

61. $s = t^3 - 3t$

(a) $v(t) = s' = 3t^2 - 3$
$a(t) = v'(t) = s'' = 2(3)t^1 - 0 = 6t$

(b) $a(2) = 6(2) = 12\ m/sec^2$

(c) acceleration when velocity is 0
need to find out $t$ when $v(t) = 0$

$$3t^2 - 3 = 0$$
$$3t^2 = 3$$
$$t^2 = 1$$
$$t = \pm 1$$
$$t = 1\text{ sec} \quad (\text{since } t \geq 0)$$

Now $a(1) = 6(1) = 6\ m/sec^2$

71. $f(x) = 2x^3 + 3x^2 - 12x + 1$

want horizontal tangent so need to find where $f'(x) = 0$

$f'(x) = 3(2)x^2 + 2(3)x^1 - 12(1) + 0 = 6x^2 + 6x - 12$

$$0 = 6x^2 + 6x - 12$$
$$0 = 6(x^2 + x - 2)$$
$$0 = 6(x+2)(x-1)$$
$$x = -2 \quad x = 1$$

$f(-2) = 2(-2)^3 + 3(-2)^2 - 12(-2) + 1 = 21$

$f(1) = 2(1)^3 + 3(1)^2 - 12(1) + 1 = -6$

$(-2, 21)$ and $(1, -6)$

73. $f(x) = 6x^3 + 5x - 3$

need to show $f'(x) \neq 4$

$f'(x) = 6(3)x^2 + 5(1) - 0 = 18x^2 + 5$

since $18x^2 + 5 \geq 5$ we know $f'(x) \geq 5$

so $f'(x) \neq 4$