

2.2 pp. 113-116 ~~(1-41, 43, 45, 49, 53, 57, 61, 63, 89, 91, 93)~~ (1-41, 50, 43, 45, 49, 53, 57, 61, 63, 89, 91, 93)

1. A. $m \approx 1/2$
 $y = x^{1/2}$
 $y' = \frac{1}{2}x^{-1/2}$
 $y' = \frac{1}{2\sqrt{x}}$
 $y'(1) = \frac{1}{2}$

11. $f(x) = x + 1$
 $f'(x) = 1$

27. $y = \frac{3}{8x^3} = \frac{3}{8}x^{-3}$
 $y' = (-3)\left(\frac{3}{8}\right)x^{-4}$
 $y' = \frac{-9}{8x^4}$

13. $f(t) = -2t^2 + 3t - 6$
 $f'(t) = -4t + 3$

15. $g(x) = x^2 + 4x^3$
 $g'(x) = 2x + 12x^2$

29. $y = \frac{\sqrt{x}}{x} = \frac{x^{1/2}}{x^1} = x^{-1/2}$
 $y' = -\frac{1}{2}x^{-3/2}$
 $y' = \frac{-1}{2x^{3/2}}$

B. $m \approx 3/2$
 $y = x^{3/2}$
 $y' = \frac{3}{2}x^{1/2}$
 $y' = \frac{3\sqrt{x}}{2}$
 $y'(1) = 3/2$

17. $s(t) = t^3 - 2t + 4$
 $s'(t) = 3t^2 - 2$

19. $y = \pi/2 \sin \theta - \cos \theta$
 $y' = \pi/2 \cos \theta + \sin \theta$

3. $y = 8$
 $y' = 0$

21. $y = x^2 - \frac{1}{2} \cos x$
 $y' = 2x + \frac{1}{2} \sin x$

31. $f(x) = \frac{3}{x^2} = 3x^{-2}$ (1, 3)
 $f'(x) = -6x^{-3}$
 $f'(x) = \frac{-6}{x^3}$
 $f'(1) = -6$

5. $y = x^6$
 $y' = 6x^5$

23. $y = \frac{1}{x} - 3 \sin x$
 $y = x^{-1} - 3 \sin x$
 $y' = -1x^{-2} - 3 \cos x$
 $y' = \frac{-1}{x^2} - 3 \cos x$

33. $f(x) = -\frac{1}{2} + \frac{7}{5}x^3$ (0, -1/2)
 $f'(x) = 3\left(\frac{7}{5}\right)x^2$
 $f'(x) = \frac{21x^2}{5}$
 $f'(0) = 0$

7. $y = \frac{1}{x^7} = x^{-7}$
 $y' = -7x^{-8}$
 $y' = \frac{-7}{x^8}$

25. $y = \frac{5}{2x^2} = \frac{5}{2}x^{-2}$
 $y' = -2\left(\frac{5}{2}\right)x^{-3}$
 $y' = \frac{-5}{x^3}$

9. $f(x) = \sqrt[5]{x} = x^{1/5}$
 $f'(x) = \frac{1}{5}x^{-4/5}$
 $f'(x) = \frac{1}{5x^{4/5}}$

$y' = \frac{-5}{x^3}$

$$35. y = (2x+1)^2 \quad (0,1)$$

$$y = 4x^2 + 4x + 1$$

$$y' = 8x + 4$$

$$y'(0) = \boxed{4}$$

$$47. f(x) = \sqrt{x} - 6\sqrt[3]{x} = x^{1/2} - 6x^{1/3}$$

$$f'(x) = \frac{1}{2}x^{-1/2} - 2x^{-2/3}$$

$$f'(x) = \frac{1}{2\sqrt{x}} - \frac{2}{x^{2/3}}$$

$$37. f(\theta) = 4\sin\theta - \theta \quad (0,0)$$

$$f'(\theta) = 4\cos\theta - 1$$

$$f'(0) = 4\cos 0 - 1$$

$$f'(0) = \boxed{3}$$

$$49. h(s) = s^{4/5} - s^{2/3}$$

$$h'(s) = \frac{4}{5}s^{-1/5} - \frac{2}{3}s^{-2/3}$$

$$h'(s) = \frac{4}{5s^{1/5}} - \frac{2}{3s^{2/3}}$$

$$39. f(x) = x^2 + 5 - 3x^{-2}$$

$$f'(x) = 2x + 6x^{-3}$$

$$41. g(t) = t^2 - \frac{4}{t^3}$$

$$g(t) = t^2 - 4t^{-3}$$

$$g'(t) = 2t + 12t^{-4}$$

$$51. f(x) = 6\sqrt{x} + 5\cos x$$

$$f'(x) = 6 \cdot \frac{1}{2}x^{-1/2} + -5\sin x$$

$$f'(x) = \frac{3}{\sqrt{x}} - 5\sin x$$

$$*43. f(x) = \frac{x^3 - 3x^2 + 4}{x^2}$$

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

$$f(x) = x - 3 + 4x^{-2}$$

$$f'(x) = 1 - 8x^{-3}$$

$$53. y = x^4 - 3x^2 + 2 \quad (1,0)$$

$$y' = 4x^3 - 6x$$

$$y'(1) = 4 - 6 = -2$$

$$y - 0 = -2(x - 1)$$

$$55. f(x) = \frac{2}{\sqrt[4]{x^3}} \quad (1,2) \quad f(x) = 2x^{-3/4}$$

$$f'(x) = 2 \left(\frac{-3}{4}\right) x^{-7/4}$$

$$f'(x) = \frac{-3}{2x^{7/4}}$$

$$y - 2 = \frac{-3}{2}(x - 1)$$

$$f'(1) = \frac{-3}{2}$$

$$45. f(x) = x(x^2 + 1)$$

$$y = x^3 + x$$

$$y' = 3x^2 + 1$$

* 57. $y = x^4 - 8x^2 + 2$
 $y' = 4x^3 - 16x$

$$4x^3 - 16x = 0$$

$$4x(x^2 - 4) = 0$$

$$4x(x+2)(x-2) = 0$$

$$\boxed{x = 0, -2, +2}$$

$$\boxed{(0, 2) (-2, -4) (2, -4)}$$

59. $y = \frac{1}{x^2} = x^{-2}$

$$y' = -2x^{-3} = \frac{-2}{x^3}$$

$$\frac{-2}{x^3} \neq 0$$

no horizontal tangent lines

61. $y = x + \sin x \quad 0 \leq x < 2\pi$
 $y' = 1 + \cos x$

$$1 + \cos x = 0$$

$$\cos x = -1$$

$$x = \pi$$

$$y(\pi) = \pi + \sin \pi = \pi$$

$$\boxed{(\pi, \pi)}$$

63. $f(x) = x^2 - kx \quad y = 4x - 9$
 $m = 4$

$$f'(x) = 2x - k$$

$$2x - k = 4 \quad k = 2x - 4$$

$$x^2 - kx = 4x - 9$$

$$x^2 - (2x - 4)x = 4x - 9$$

$$x^2 - 2x^2 + 4x = 4x - 9$$

$$-x^2 = -9$$

$$0 = x^2 - 9$$

$$0 = (x+3)(x-3)$$

$$x = 3, -3$$

$$k = 2(3) - 4 \quad k = 2(-3) - 4$$

$$\boxed{k = 2}$$

$$\boxed{k = -10}$$

65. $f(x) = \frac{k}{x} \quad y = \frac{-3}{4}x + 3$

$$f(x) = kx^{-1}$$

$$f'(x) = -kx^{-2} = \frac{-k}{x^2}$$

$$\frac{-k}{x^2} = \frac{-3}{4} \quad ; \quad 4k = 3x^2$$

$$k = \frac{3}{4}x^2$$

$$\frac{k}{x} = \frac{-3}{4}x + 3 \quad k = \frac{3}{4}(2)^2$$

$$\frac{\frac{3}{4}x^2}{x} = \frac{-3}{4}x + 3$$

$$\boxed{k = 12}$$

$$\frac{3x}{4} = \frac{-3}{4}x + 3$$

$$\boxed{k = 3}$$

$$3x = -3x + 12$$

~~$$3x = -3x + 12$$~~

$$6x = 12, x = 2$$

88. $f(t) = 2t + 7$ $[1, 2]$

avg roc $\frac{f(2) - f(1)}{2 - 1} = \frac{11 - 9}{1} = \boxed{2}$

$f'(t) = 2$ $\begin{cases} f'(1) = 2 \\ f'(2) = 2 \end{cases}$

93. $s(t) = -4.9t^2 + v_0t + s_0$
 $v_0 = 120 \text{ m/sec}$ $s_0 = 0$

$s(t) = -4.9t^2 + 120t$

$s'(t) = -9.8t + 120$

$\begin{cases} s'(5) = 71 \text{ ft} \\ s'(10) = 22 \text{ ft} \end{cases}$

89. $f(x) = -\frac{1}{x}$ $[1, 2]$ $f(x) = -1x^{-1}$

A_{roc} = $\frac{f(2) - f(1)}{2 - 1} = \frac{-\frac{1}{2} - (-1)}{1} = \boxed{\frac{1}{2}}$

$f'(x) = x^{-2} = \frac{1}{x^2}$

$\begin{cases} f'(1) = 1 \\ f'(2) = \frac{1}{4} \end{cases}$

$108 = -4.9t^2 + 120t$

$0 = -4.9t^2 + 120t - 108$

graph + look for intercept!

$t = 0.86915337$

$v(0.86915337) = 111.482297$
 $\boxed{111.482 \text{ m/sec}}$

91. $s(t) = -16t^2 + v_0t + s_0$

D. $0 = -16t^2 + 1362$

$-1362 = -16t^2$

$85.125 = t^2$

$\boxed{t = 9.226 \text{ sec}}$

a. $v_0 = 0$ $s_0 = 1362$

$s(t) = -16t^2 + 1362$

$v(t) = -32t$

b. Avg roc = $\frac{s(2) - s(1)}{2 - 1} = \frac{1298 - 1346}{1} = \boxed{-48 \text{ ft/sec}}$

c. $s'(t) = -32t$

$\begin{cases} s'(1) = -32 \text{ ft/sec} \\ s'(2) = -64 \text{ ft/sec} \end{cases}$

E. $s'(9.226321044) = \boxed{-295.242 \text{ ft/sec}}$