

HW for 2/8 - Section 1.3

(2) $f(x) = -3x + 7$

$$f'(x) = -3$$

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

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

(10) $f(x) = 3^2 = 9$

$$f'(x) = 0$$

(12) $f(x) = \frac{1}{x^{-5}} = x^5$

$$f'(x) = 5x^4$$

(14) $f(x) = \frac{1}{\sqrt[7]{x}} = x^{-1/7}$

$$f'(x) = -\frac{1}{7} x^{-8/7}$$

(16) $f(x) = 5\sqrt{x} = x^{1/5}$

$$f'(x) = \frac{1}{5} x^{-4/5}$$

(18) $f(x) = x^5$ @ $x = 2/3$

$$f'(x) = 5x^4$$

$$f'(2/3) = 5\left(\frac{2}{3}\right)^4 = 5\left(\frac{16}{81}\right) = \frac{80}{81}$$

(22) $f(x) = x^{3/2}$ at $x = 4$

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

$$f'(4) = \frac{3}{2} \sqrt{4} = \frac{3}{2} (2) = 3$$

(26) slope of $y = x^5$ @ $x = -2$ ← This is the same as the value of the derivative at this point.

$$\frac{dy}{dx} = 5x^4$$

$$\left. \frac{dy}{dx} \right|_{-2} = 5(-2)^4 = 5(16) = 80$$

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

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

$$f(5) = \frac{1}{5^2} = \frac{1}{25}$$

$$f'(5) = \frac{-2}{(5)^3} = \frac{-2}{125}$$

(34) $f(x) = x^3$ $x = -2$

$$f(-2) = (-2)^3 = -8 \text{ so } (-2, -8) \text{ is on graph}$$

$$f'(x) = 3x^2$$

$$f'(-2) = 3(-2)^2 = 3(4) = 12 \text{ so } m = 12$$

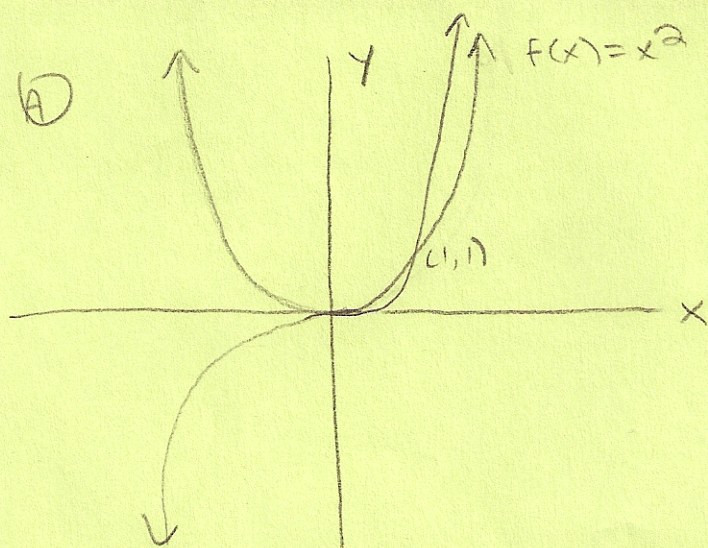
plug into point-slope: $y - (-8) = 12 \cdot (x - (-2))$

$$y + 8 = 12x + 24$$

$$y = 12x + 16$$

(47)

(A)



$$f(1) = g(1) = 1$$

at (1,1) $g(x)$ has a greater slope than $f(x)$.

(B)

$$f(x) = x^2$$

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

$$f'(1) = 2(1) = 2$$

$$g(x) = x^3$$

$$g'(x) = 3x^2$$

$$g'(1) = 3(1)^2 = 3$$

$$(50) \quad \frac{d}{dx} (x^{-3}) = -3x^{-4}$$

$$(55) \quad \frac{dy}{dx} \text{ if } y = x^{1/5}$$

$$\frac{dy}{dx} = \left(\frac{1}{5}\right) x^{-4/5}$$

(57) $f(6)$ will be on tangent line

$$y = \frac{x}{3} + 2$$

$$y = \frac{6}{3} + 2 = 2 + 2 = 4$$

$f'(6)$ is slope of tangent

$$y = \frac{x}{3} + 2 = \left[\frac{1}{3}\right]x + 2 \quad \text{so } f'(6) = \frac{1}{3}$$

$$(58) \quad y = \sqrt{x} = x^{1/2}$$

$$\frac{dy}{dx} = \frac{1}{2} x^{-1/2} = \frac{1}{2\sqrt{x}}$$

but we know $\left. \frac{dy}{dx} \right|_a = \frac{1}{4}$

↑
slope of tangent line
at $x=a$

$$\text{so } \frac{1}{4} = \frac{1}{2\sqrt{a}}$$

$$2\sqrt{a} = 4$$

$$\sqrt{a} = 2$$

$$a = 4$$

now $f(4) = \sqrt{4} = 2$, which should be a point on the tangent line

$$y = f(4) = 2 = \frac{1}{4}(2) + b$$

↑
tangent line

$$2 = \frac{1}{2} + b$$

$$b = 3/2$$

Section 1.6

(2) $y = 3x^4$

$$\frac{dy}{dx} = 12x^3$$

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

$$\frac{dy}{dx} = (-1)x^{-4} = -\frac{1}{x^4}$$

(6) $f(x) = 12 + \frac{1}{7^3} = [\text{some constant}]$

$$f'(x) = 0$$

(8) $y = 4x^3 - 2x^2 + x + 1$

$$\frac{dy}{dx} = 12x^2 - 4x + 1 + 0 = 12x^2 - 4x + 1$$

(36) $y = \pi^2 x$

$$\frac{dy}{dx} = \pi^2$$

(39) $f(x) = 3x^2 - 2x + 1 \quad (1, 2)$

$$f'(x) = 6x - 2$$

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

(42) equation of tan line:

$$y = x^3 + 3x - 8 \quad (2, 6)$$

$$\frac{dy}{dx} = 3x^2 + 3$$

$$\left. \frac{dy}{dx} \right|_2 = 3(2)^2 + 3 = 3(4) + 3 = 12 + 3 = 15$$

(cont.)

(cont.)

so tan line has slope 15 and contains (2,6)

$$y - 6 = 15(x - 2)$$

$$y - 6 = 15x - 30$$

$$y = 15x - 24$$

$$(49) \quad h(x) = 3f(x) + 2g(x)$$

$$h(5) = 3f(5) + 2g(5)$$

$$= 3(2) + 2(4)$$

$$= 6 + 8 = 14$$

$$h'(x) = 3f'(x) + 2g'(x)$$

$$h'(5) = 3(3) + 2(1)$$

$$= 9 + 2 = 11$$

Section 1.7

(34 a)

$$f(t) = t^{10}$$

$$f'(t) = 10t^9$$

$$f''(t) = 90t^8$$

$$f'''(t) = 720t^7$$

(37)

$C(50) = 5000$: It costs \$5000 to produce 50 bicycles a day.

$C'(50) = 45$: This measures change in bicycles per day over change in time.

Since $C'(50) = 45$, the marginal cost of the 51st bicycle is \$45.

Section 1.8

#2 (a) $f(x) = -6/x = -6x^{-1}$

between 1 and 2

$$\bar{y} = \frac{f(2) - f(1)}{2 - 1} = \frac{-3 - (-6)}{1} = 3$$

between 1 and 1.5

$$\bar{y} = \frac{f(1.5) - f(1)}{1.5 - 1} = \frac{-4 - (-6)}{.5} = 4$$

$$\bar{y} = \frac{f(1.2) - f(1)}{1.2 - 1} = \frac{5 - (-6)}{.2} = 5$$

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

$$f'(1) = 6(1)^{-2} = 6$$

(10) $f(t) = 5t - \sqrt{t} = 5t - t^{1/2}$

rate in gallons
per hour is $f'(4)$

$$f'(t) = 5 - \frac{1}{2\sqrt{t}}$$

$$f'(4) = 5 - \frac{1}{2\sqrt{4}} = 5 - \frac{1}{4} = 4.75$$

(13) $s(t) = 160t - 16t^2$

(a) initial velocity:

$$s'(t) = 160 - 32t$$

$$s'(0) = 160 - 0 = 160 \text{ ft/s}$$

(b) $s'(2) = 160 - 32(2) = 96 \text{ ft/s}$

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

$$s''(3) = -32 \text{ ft/s}^2$$

(d) $s(t) = 0$ when rocket hits ground

$$160t - 16t^2 = 0$$

$$t(10 - t) = 0 \quad t = 0 \text{ or } \boxed{t = 10 \text{ seconds}}$$

(14) (a)



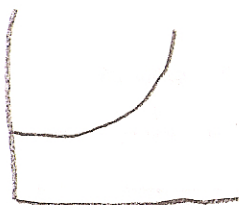
(b)



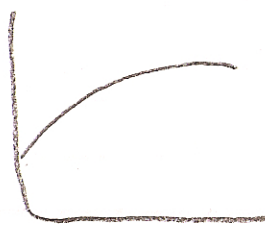
(c)



(d)



(e)



$$(2) \quad f(25) = 10 \quad f'(25) = -2$$

$$\text{use: } f(a+h) \approx f(a) + f'(a) \cdot h$$

$$(a) \quad f(27) \approx f(25) + 2(-2)$$

$$\approx 10 - 4$$

$$\approx 6$$

$$(b) \quad f(26) \approx f(25) + 1(-2)$$

$$= 10 - 2$$

$$= 8$$

$$(c) \quad f(25.25) \approx f(25) + 0.25(-2)$$

$$\approx 10 - 0.5$$

$$\approx 9.5$$

$$(d) \quad f(24) \approx f(25) - 1(-2)$$

$$f(24) \approx 10 + 2$$

$$\approx 12$$

$$(e) \quad f(23.5) \approx f(25) - 1.5(-2)$$

$$\approx 10 + 3$$

$$\approx 13$$