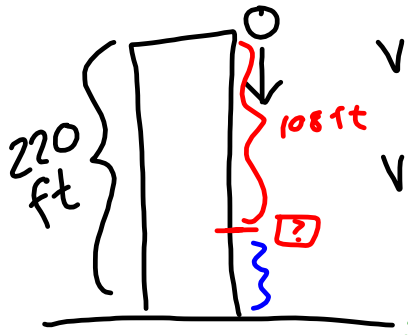
92.



initial velocity $v_0 = -22$ ft/s

$v(3) = ?$ $-32(3) - 22 = \boxed{-118 \text{ ft/s}}$

$v(t) = ?$ after falling 108 ft

$220 - 108 = -16t^2 - 22t + 220$

$16t^2 + 22t - 108 = 0$

Solve($16t^2 + 22t - 108 = 0$, t)

$t = 2$ s

$s(t) = \frac{1}{2}at^2 + v_0t + s_0$

$g = -9.8 \text{ m/s}^2$

$= -32 \text{ ft/s}^2$

$s(t) = -16t^2 - 22t + 220$ position

$v(t) = s'(t) = -32t - 22$ velocity

$a(t) = v'(t) = -32$ acceleration

$v(2) = -32(2) - 22$

$= \boxed{-86 \text{ ft/s}}$

sphere volume: $V = \frac{4}{3}\pi r^3$

find the rate of change of volume w.r.t. radius when $r = 2$ cm.

$\frac{dV}{dr} = V' = 4\pi r^2$ (surface area of sphere)

$V'\Big|_{r=2} = 4\pi(2)^2 = \boxed{16\pi \text{ cm}^2}$

average rate of change of volume as radius changes from 1 cm to 3 cm?

$\frac{\Delta V}{\Delta r} = \frac{V(3) - V(1)}{3 - 1} = \frac{\frac{4}{3}\pi(3)^3 - \frac{4}{3}\pi(1)^3}{3 - 1}$

$= \frac{36\pi - \frac{4}{3}\pi}{2} = 18\pi - \frac{2}{3}\pi = \boxed{\frac{52\pi}{3} \text{ cm}^2}$

Power Rule:

$\frac{d}{dx}[x^n] = nx^{n-1}$ d/dx [c]=0

Product Rule:

$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$

Constant Multiple Rule:

$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

Quotient Rule:

$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{g^2(x)}$

Sum & Difference:

$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Chain Rule:

$\frac{d}{dx}[f(g(x))] = f'(g(x))g'(x)$

Trig Functions:

$\frac{d}{dx}[\sin x] = \cos x$ $\frac{d}{dx}[\tan x] = \sec^2 x$ $\frac{d}{dx}[\sec x] = \sec x \tan x$

$\frac{d}{dx}[\cos x] = -\sin x$ $\frac{d}{dx}[\cot x] = -\csc^2 x$ $\frac{d}{dx}[\csc x] = -\csc x \cot x$

2.3 Product & Quotient Rules

$[fg]' = \frac{d}{dx}[f(x)g(x)] \neq f'(x)g(x) + f(x)g'(x)$

$(fg)' = f'g + fg'$

$\left[\frac{f}{g}\right]' = \frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$

"low dee high less high dee low, draw the line and square below"

$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$

2.3

6. $g(x) = (\sqrt{x})(\sin x)$

$$g'(x) = (\sqrt{x})'(\sin x) + (\sqrt{x})(\sin x)'$$

$$= \left(\tfrac{1}{2}x^{-1/2}\right)(\sin x) + (\sqrt{x})(\cos x)$$

12. $f(t) = \dfrac{\cos t}{t^3} = (\cos t)(t^{-3})$

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

$$= \frac{(t^3)(-\sin t) - (\cos t)(3t^2)}{(t^3)^2}$$

$$f'(t) = (\cos t)(-3t^{-4}) + (-\sin t)(t^{-3})$$

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

Note: as a product,

$f(x) = (x^3+3x+2)(x^2-1)^{-1}$

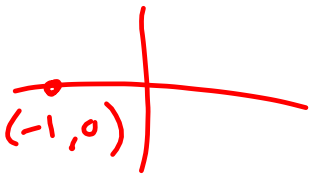
we don't know how to differentiate this yet so we have to use the quotient rule!

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

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

Find the slope of the tangent line

$f(x) = 3x - \sin x \quad ; (\pi, 3\pi)$



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

$m = f'(\pi) = 3 - \cos\pi = 3 - (-1) = \boxed{4}$

Find the equation of the tangent line.

$f(x)=2x^3+\sin x-2x \quad ; (0,0)$

$f'(x) = 6x^2 + \cos x - 2$

$m = f'(0) = 6(0)^2 + \cos(0) - 2$

$= 0 + 1 - 2 = -1$

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

$\boxed{y = -x}$

2.1

32. $f(x) = \frac{1}{x+1}$; $(0,1) = (x_1, y_1)$

find the equation of the tangent line to f at the given point

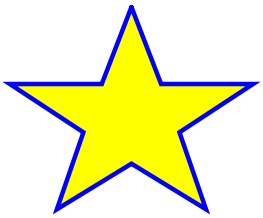
$f'(x) = \frac{(x+1)(1)' - (1)(x+1)'}{(x+1)^2}$

$= \frac{(x+1)(0) - (1)(1)}{(x+1)^2} = \frac{-1}{(x+1)^2}$

$m = f'(0) = \frac{-1}{(0+1)^2} = -1$

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

$\boxed{y = -x + 1}$



Homework for Test #2 on Derivatives

HW #4 (due Fri 12/05)

- 2.1 #1-23 odd — Find the derivative by the limit process
  #29-32 all — find the equation of the tangent line
  #61-69 odd — Use the alternate form to find the derivative
  #71-79 odd — Describe x-values where the function is differentiable (given graph)
- 2.2 #3-51 odd — Find the derivative using the basic derivative rules
  #91-94 all; 101, 102 — use the derivative to solve rate of change word problems
- 2.3 #1-53 odd, 63-69 odd, 75-81 all, 83-91 odd, 109-115 all — Product and quotient rules
- 2.4 #7-33 odd — Chain rule

HW #5

- 2.4 #47-81 odd — Chain rule
- 5.1 #45-61, 71 — Logarithmic functions
- 5.4 #39-57 — Exponential functions
- 5.5 #41-55 — Log and exp functions with other bases
- 5.8 #41-59 — Inverse trig functions