

# 208 Sample Problems - Set One KEY

#1

$$y = -16t^2 + 50t + 5$$

$$y' = -32t + 50 = 0 \text{ iff } -32t = -50$$

$$t = 50/32 = 25/16 = 1.5625 \text{ sec.}$$

$$y|_{t=25/16} = -16\left(\frac{25}{16}\right)^2 + 50\left(\frac{25}{16}\right) + 5$$

$$= \frac{705}{16} = 44.0625$$

at  $t=0$ ,  $y=5$  feet

When ball hits ground,  $y=0$  feet

about 44 feet \*

#2

$$f(x) = x^3 - 9x^2 - 48x + 52$$

$$f'(x) = 3x^2 - 18x - 48$$

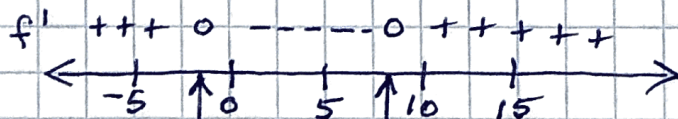
$$= 3(x^2 - 6x - 16) = 0$$

$$x^2 - 6x - 16 = 0$$

$$(x-8)(x+2) = 0$$

$$x = 8 \quad x = -2$$

x	f(x)
-5	-58
-2	104
8	-396
12	-92
14	360



f inc ↑ dec ↑ inc  
local max local min

GLOBAL MAX

GLOBAL MIN

(a)  $(-2, 104)$

~~(8, -396)~~  
 $(8, -396)$

ON  $[-5, 12]$

(b)  $(14, 360)$

$(8, -396)$

ON  $[-5, 14]$

(c) NONE

$(8, -396)$

ON  $[-5, \infty)$

#3

$$H = 4 + 16e^{-0.02t}$$

$$\frac{dH}{dt} = 16e^{-0.02t}(-0.02) = -0.32e^{-0.02t}$$

at  $t=0$ ,  $\frac{dH}{dt} = -0.32 \text{ } ^\circ\text{C}/\text{min}$

at  $t=10$ ,  $\frac{dH}{dt} = -0.32e^{-0.02(10)} = -0.32e^{-0.2}$

$\approx -0.262 \text{ } ^\circ\text{C}/\text{min}$

#4  $xy = 100 \quad \frac{dy}{dt} = 5$

$D_t(xy) = D_t(100)$

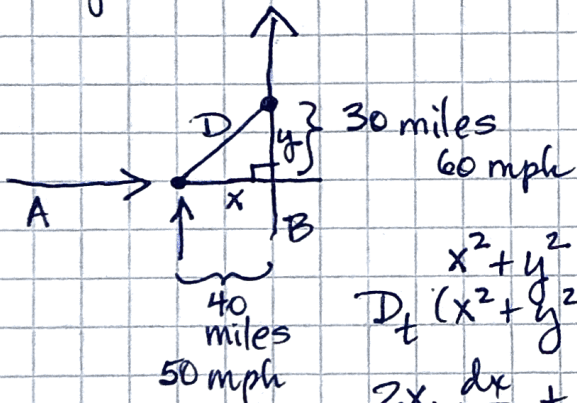
$x \cdot \frac{dy}{dt} + y(1) = 0 \rightarrow x \cdot \frac{dy}{dt} + y = 0 \rightarrow \boxed{\frac{dy}{dt} = -\frac{y}{x}}$

(a)  $x=10 \Rightarrow \frac{dy}{dt} = -\frac{10}{10} = \boxed{-1}$

(b)  $x=25 \Rightarrow \frac{dy}{dt} = \boxed{-\frac{4}{25}}$

(c)  $x=50 \Rightarrow \frac{dy}{dt} = -\frac{2}{50} = \boxed{-\frac{1}{25}}$

#5



$D^2 = 40^2 + 30^2$   
 $D = 50$

$x^2 + y^2 = D^2$   
 $D_t(x^2 + y^2) = D_t(D^2)$

$2x \cdot \frac{dx}{dt} + 2y \cdot \frac{dy}{dt} = 2D \frac{dD}{dt}$

$x \cdot \frac{dx}{dt} + y \cdot \frac{dy}{dt} = D \frac{dD}{dt}$

$40(50) + 30(60) = (50) \frac{dD}{dt}$

$\frac{2000 + 1800}{50} = \frac{dD}{dt}$

$\frac{3800}{50} = \frac{dD}{dt}$

$\boxed{76} = \frac{dD}{dt}$

**76 mph**

Positive  $\frac{dD}{dt} \rightarrow$  **Farther Apart**