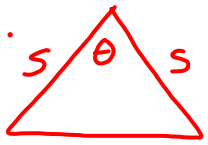
Homework questions?

Quiz - Tues Oct 1 (implicit differentiation, rates of change)
Test #3 - Fri Oct 11?

2.6

17.



$A = \frac{1}{2}s^2 \sin\theta$

$\frac{d\theta}{dt} = \frac{1}{2}$ rad/min

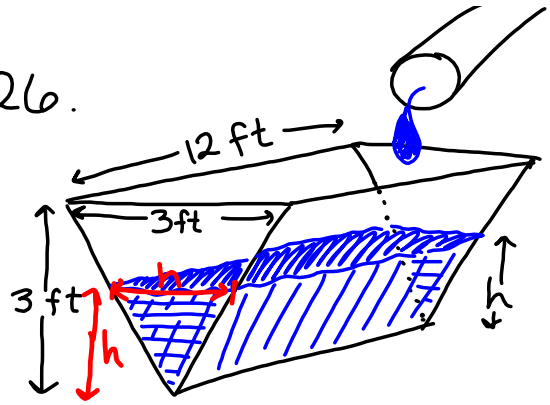
$\frac{dA}{dt} = ?$ when $\theta = \frac{\pi}{6}$

$$\frac{dA}{dt} = \frac{1}{2}s^2 \cos\theta \cdot \frac{d\theta}{dt}$$

$$= \frac{1}{2}s^2 \cos\frac{\pi}{6} \cdot \frac{1}{2}$$

$$= \boxed{\frac{s^2\sqrt{3}}{8} \text{ in}^2/\text{min}}$$

26.



$\frac{3}{3} = \frac{h}{h}$

(a) $\frac{dV}{dt} = 2$ ft^3/min

$\frac{dh}{dt} = ?$ when $h = 1$

$V = \frac{1}{2}h^2 \cdot 12$

$V = 6h^2$

$$\frac{dV}{dt} = 12h \cdot \frac{dh}{dt}$$

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{12h}$

$= \frac{2}{12 \cdot 1} = \frac{1}{6}$

$= \boxed{\frac{1}{6} \text{ ft/min}}$

(b) $\frac{dh}{dt} = \frac{3}{8}$ in/min

$h = 2$

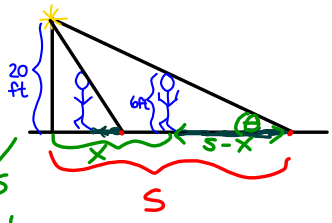
$$\frac{dV}{dt} = (12\text{ft})(2\text{ft})\left(\frac{3\text{ in}}{8\text{ min}}\right)\left(\frac{1\text{ ft}}{12\text{ in}}\right) = \boxed{\frac{3\text{ ft}^3}{4\text{ min}}}$$

36. A man 6 ft tall walks toward a light that is 20 ft above the ground at a rate of 5 ft/s. When he is 10 ft from the base of the light,

(a) at what rate is the tip of his shadow moving?

(b) at what rate is the length of his shadow changing?

(a) Let s = distance from the light to the tip of the man's shadow



$\frac{dx}{dt} = 5 \frac{ft}{s}$

$\frac{ds}{dt} = ?$ when $x = 10$

x = distance from light to man

$\frac{20}{s} = \frac{6}{s-x}$

$20(s-x) = 6s$

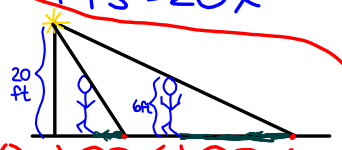
$20s - 6s = 20x$

$14s = 20x$

$s = \frac{10}{7}x$

$\frac{ds}{dt} = \frac{10}{7} \cdot \frac{dx}{dt}$

$= \frac{10}{7} \cdot 5 = \frac{50}{7} \frac{ft}{s}$



(b) s = length of shadow

x = distance to man

$\frac{20}{x+s} = \frac{6}{s}$

$20s = 6(x+s)$

$20s = 6x + 6s$

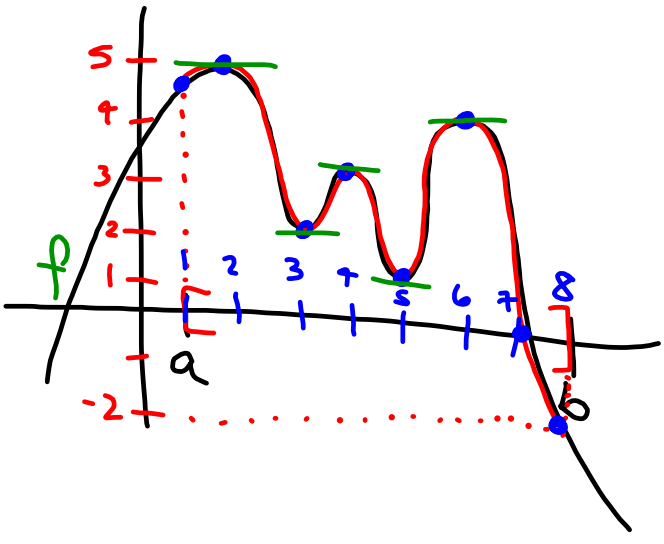
$14s = 6x$

$s = \frac{3}{7}x$

$\frac{ds}{dt} = \frac{3}{7} \frac{dx}{dt} = \frac{3}{7} \cdot 5 = \frac{15}{7} \frac{ft}{s}$

3.1 Extrema on an Interval

- maxima & minima
- relative & absolute



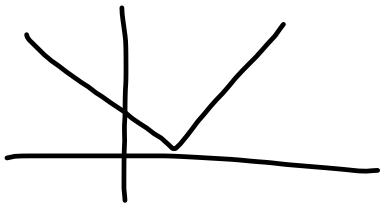
relative minima: (3,2), (5,1)

relative maxima: (2,5), (4,3), (6,4)

absolute maximum: 5 @ (2,5)

absolute minimum: -2 @ (8,-2)

$f(x)$ has a relative maximum or minimum when $f'(x) = 0$. or $f'(x)$ is undefined.



We call such x-values Critical #'s of f.

3.1

28. $h(t) = \frac{t}{t-2}$, $[3,5]$

$h'(t) = \frac{(t-2) - t(1)}{(t-2)^2} = \frac{-2}{(t-2)^2}$

where is $h'(t) = 0$? nowhere

where is $h'(t)$ undefined? $t = 2$

2 is only critical # but it's not in $[3,5]$ so ignore it!

Look @ endpoints:

$h(3) = \frac{3}{3-2} = 3$

$h(5) = \frac{5}{5-2} = \frac{5}{3}$

$\Rightarrow$ Absolute maximum of 3, which occurs when $x = 3$

Absolute minimum of $\frac{5}{3}$, which occurs when $x = 5$

30. $g(x) = \sec x$, $\left[\frac{-\pi}{6}, \frac{\pi}{3}\right]$

$g'(x) = \sec x \tan x$

$= \frac{1}{\cos x} \cdot \frac{\sin x}{\cos x}$

$g'(x) = 0$ when $\sin x = 0 \Rightarrow x = 0$

$g'(x)$ is undefined when $\cos x = 0$ nowhere

critical #: 0

$\sqrt{1} < \sqrt{3} < \sqrt{4}$ $g\left(\frac{-\pi}{6}\right) = \sec(-\pi/6) = \frac{2}{\sqrt{3}}$

$1 < \sqrt{3} < 2$ $g(0) = \sec(0) = 1$

$1 > \frac{1}{\sqrt{3}} > \frac{1}{2}$ $g(\pi/3) = \sec(\pi/3) = 2$

$2 > \frac{2}{\sqrt{3}} > 1$

Abs max of 2 when $x = \frac{\pi}{3}$

Abs min of 1 when $x = 0$

Homework:

2.6 #25,27,35

3.1 HW

17-31 odd