Good afternoon: no warm up, we'll randomize then learn about

Linear Approximations and Normal Lines

Out for DS yesterday?
Check out mcalc.weebly.com for notes/vid on
Horizontal and Vertical Tangents

Helpful hints for the AP packet due Monday

- 4th derivative??

take the derivative of the derivative
to get the 2nd derivative
and so on

- $\frac{d^2y}{dx^2}$ = means 2nd derivative

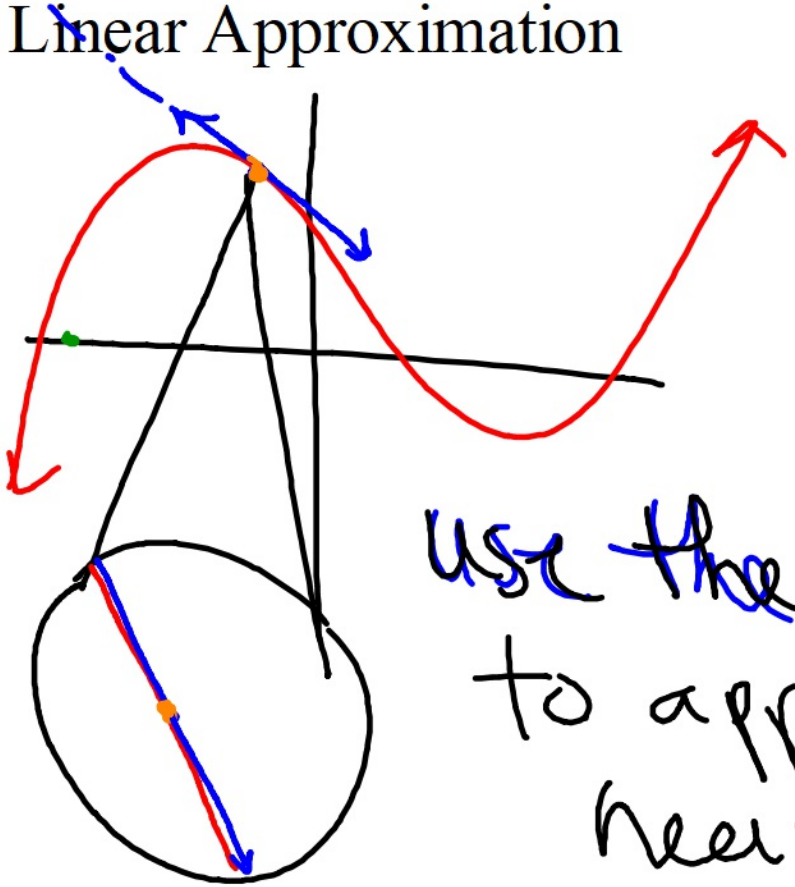
- p18 88BC #3

2 primes means 2nd derivative

88 BC 3. If $f(x) = \ln\left(\sqrt{x}\right)$, then $f''(x) =$

(A) $-\frac{2}{x^2}$ (B) $-\frac{1}{2x^2}$ (C) $-\frac{1}{2x}$ (D) $-\frac{1}{2x^{\frac{3}{2}}}$ (E) $\frac{2}{x^2}$

Linear Approximation



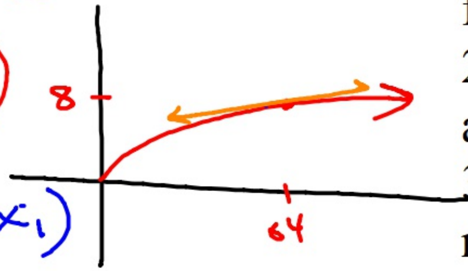
Use the tan line to approx. function near pt. of tangency.

Approximate $\sqrt{63}$

1. identify function, find 'close' point
2. write tan line at the close point
3. Plug in the weird number into the tan line

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

$(64, 8)$



$y - y_1 = m(x - x_1)$

$y - 8 = m(x_1 - 64)$

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

$f'(64) = \frac{1}{2 \cdot \sqrt{64}} = \frac{1}{16}$

$y - 8 = \frac{1}{16}(x - 64)$

Let $x = 63$

$y - 8 = \frac{1}{16}(63 - 64)$ ($63 - 64 = -1$)

$y - 8 = -\frac{1}{16} \Rightarrow y = 8 - \frac{1}{16}$

$y = 7\frac{16}{16} - \frac{1}{16} = 7\frac{15}{16}$

Approximate $\sqrt[5]{245}$

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

$(243, 3)$

$y - 3 = m(x - 243)$

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

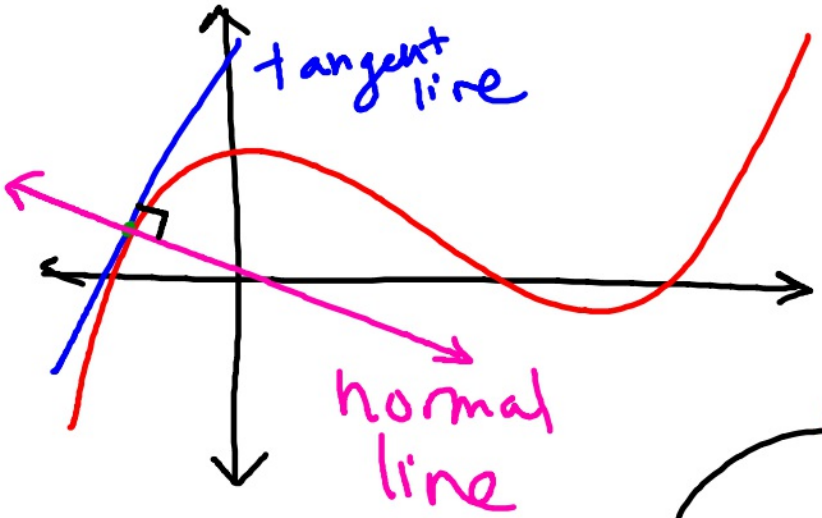
$f'(243) = \frac{1}{5\sqrt[5]{243^4}}$???

$\frac{1}{5 \cdot 81} = \frac{1}{405}$

$y - 3 = \frac{1}{405}(x - 243)$

$y = 3\frac{2}{405}$

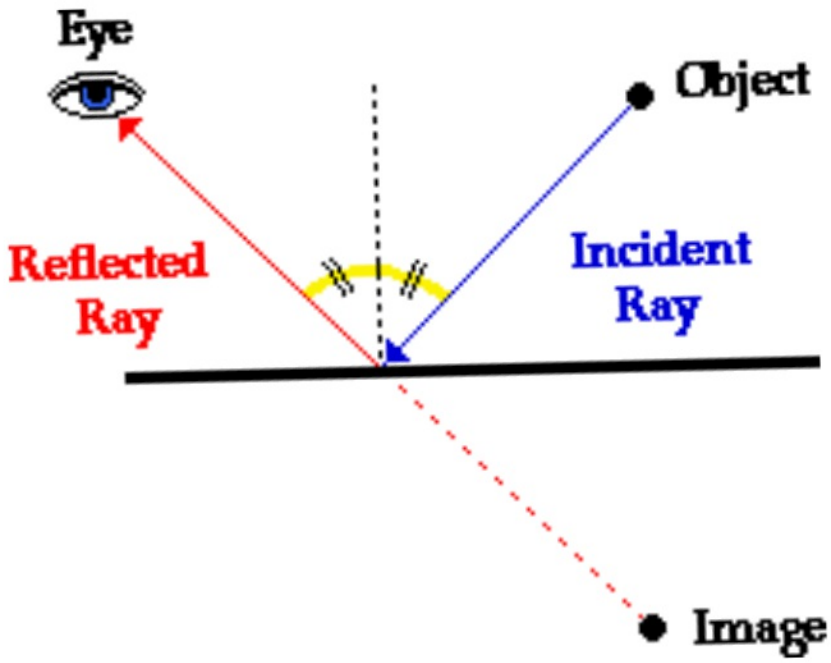
Normal Lines

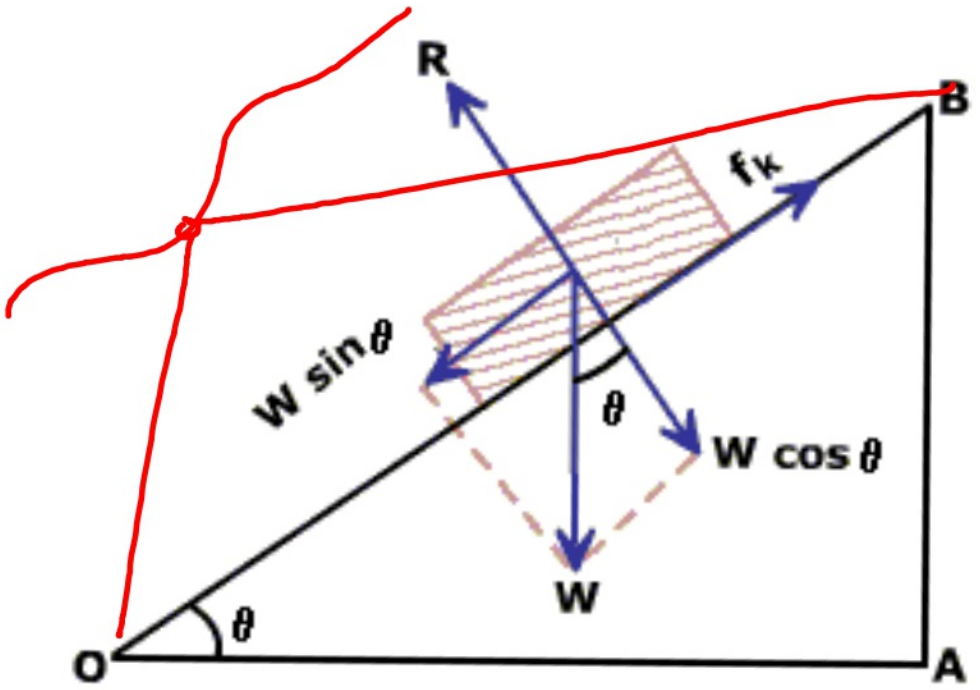


other synonyms:
perpendicular, orthogonal

Perp. Slopes

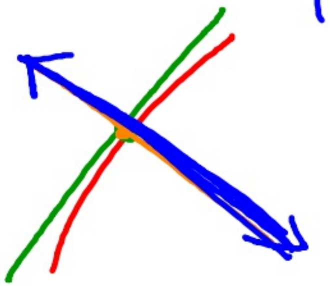
$$\frac{a}{b} \perp -\frac{b}{a}$$





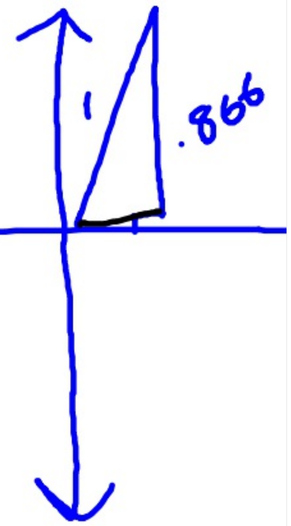
Body accelerating down an inclined plane

Write the equation of the line normal to y=sin(x) when x=π/3



$y - y_1 = m(x - x_1)$

need y_1: $\sin(\pi/3) = \frac{\sqrt{3}}{2}$

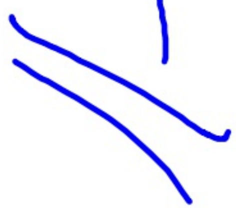


need m: $\frac{dy}{dx} = \cos(x)$

$= \cos(\pi/3) = .5 = \frac{1}{2}$

A

⊥ $-\frac{2}{1}$



$$y - \frac{\sqrt{3}}{2} = -2\left(x - \frac{\pi}{3}\right)$$

Write the equation of a line normal to $y= x^{-1}(x+2)$ when $x=1$

The Tangent Line Game!!!

match a function card ,with a derivative card, with a tangent line card

work with your elbow partner

#1 – 10 F

#11 – 20 F'

#31 – 40 tan lines

HW

finish the AP derivative rules ~~handout~~ packet due Tues.