Panel 1

Next Quiz

Related Rates ✓

✓ Linear Approx $f(x) \approx f'(a)(x-a) + f(a)$ linear equation of tangent for $x$ close to $a$

Error Estimates

P

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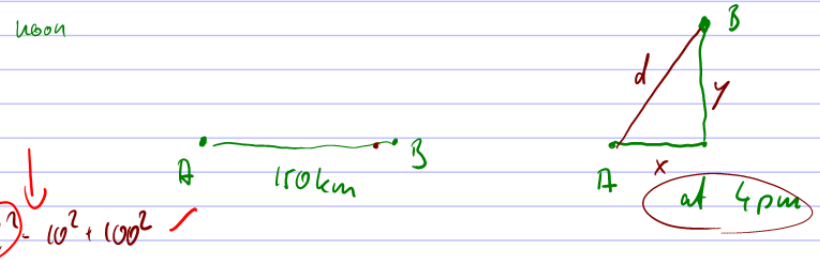
Panel 2

Page 131 #10 Ship A is 150 km west of ship B at noon. A sails east at 35 km/h B sails north at 25 km/h. Rate Distance changing at 4 pm




$d^2 = 150^2 + 100^2$ ✓

$d^2 = x^2 + y^2$

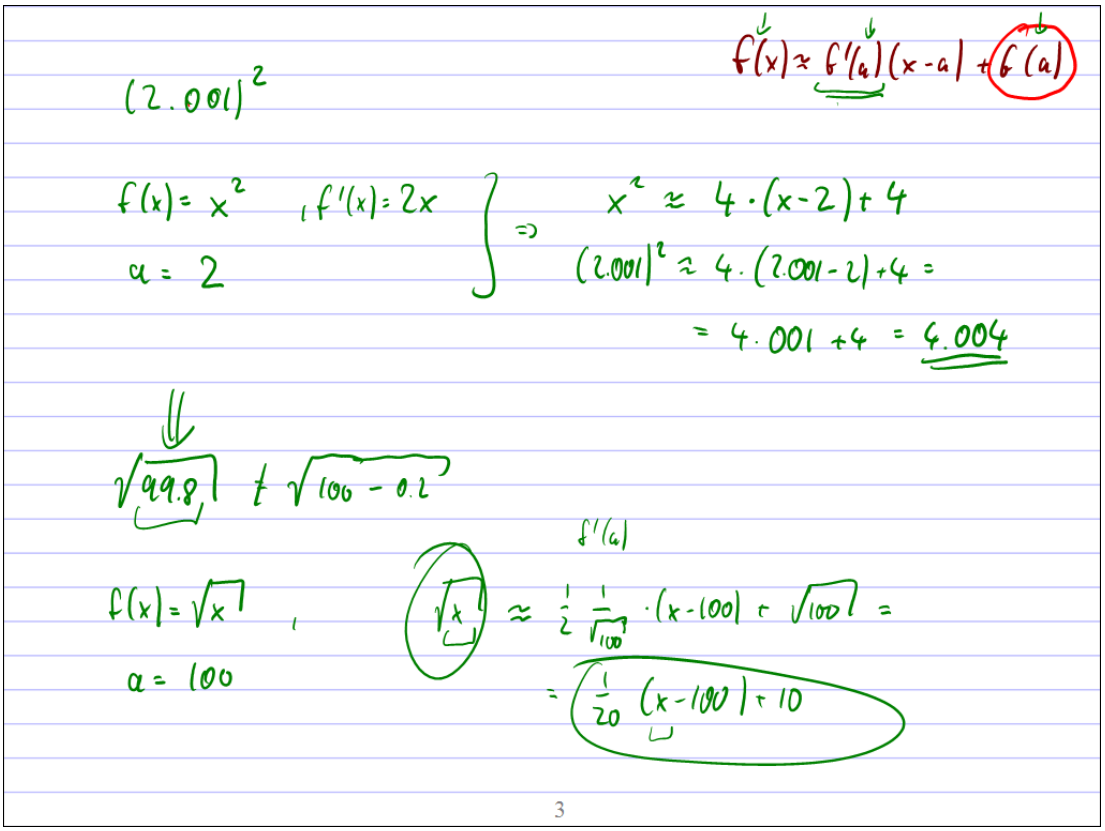
$2d\,d' = 2xx' + 2yy'$

$x' = 35$, $x = 150$

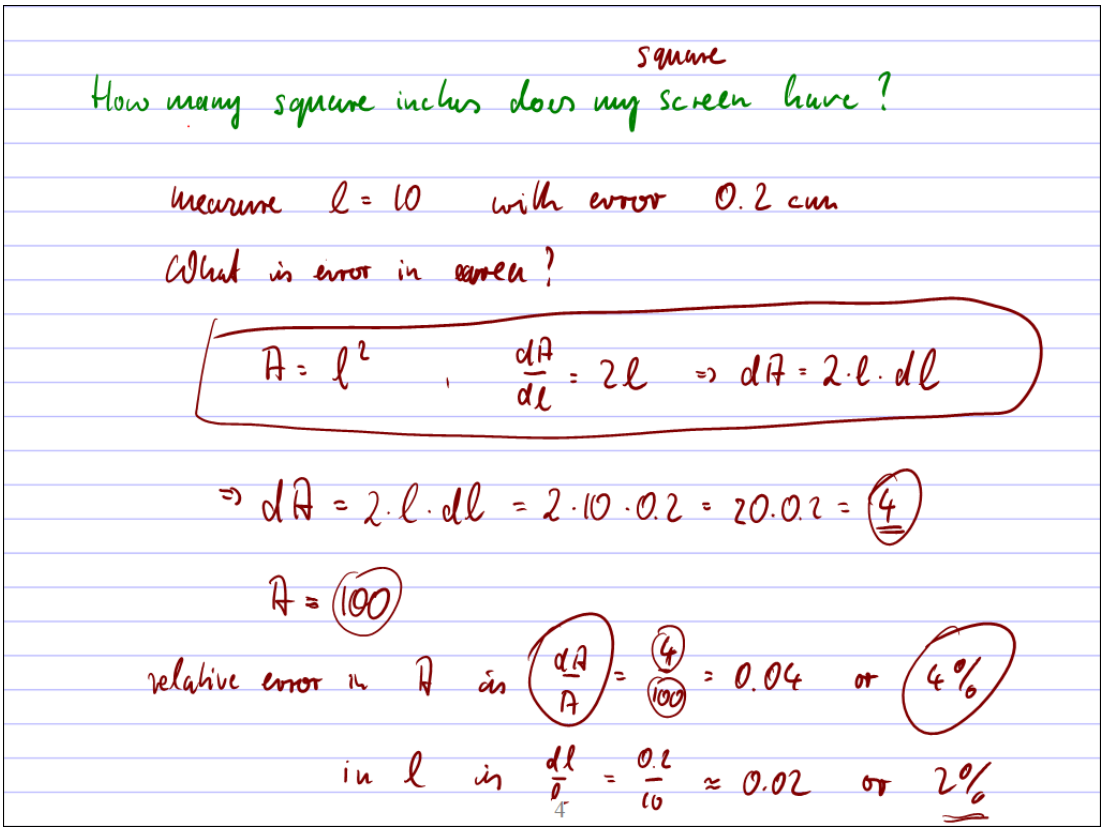
$y' = 25$, $y = 100$ | tricky

2

Panel 3




Panel 4



Panel 5

took a quiz like Quiz 3 again,

and also quiz #4

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Panel 6

Last time:

relative max and min

absolute max and min

Extreme Value Theorem: Every continuous function on a closed interval $[a,b]$ has abs. max + min.

Fermat's Theorem: If $f$ has rel. max or min at $x=c$, and $f'(c)$ exists, then $f'(c)=0$

Critical points: where $f'=0$ or $f'$ d.n.e.

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Panel 7

How to find local extrema (min or max)

1.) $f' = 0$ or $f'$ d.n.e. $\Rightarrow$ critical

2.) Make table using critical points

3.) Decide on signs of $f'$ to conclude about $f$.

Ex: $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$

1.) $f'(x) = 12x^3 - 12x^2 - 24x = 0$

$= 12x(x^2 - x - 2) =$

$\Rightarrow = 12x(x-2)(x+1) = 0$

$+ \quad - \quad +$

$x = 0, \; x = 2, \; x = -1$

max min min

| | $-1 - 0.00001$ | $-1 + 0.00001$ | $0 - 0.00001$ | $0 + 0.00001$ | $2 - 0.00001$ | $2 + 0.00001$ |
|---|---|---|---|---|---|---|
| $f'$ | $-$ | $+$ | $+$ | $-$ | $-$ | $+$ |
| $f$ | $\searrow$ | $\nearrow$ | $\nearrow$ | $\searrow$ | $\searrow$ | $\nearrow$ |

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Panel 8

$f(x) = x^{3/5}(4-x)$ find local extrema

$f'(x) = \frac{3}{5}x^{-2/5}(4-x) + x^{3/5}(-1) = 0$

$\frac{3}{5}x^{-\frac{2}{5}}(4-x) = x^{3/5} \quad | \cdot 5x^{2/5}$

$3(4-x) = 5x$

$12 - 3x = 5x$

$12 = 8x$

$\frac{12}{8} = x$ is critical. Also $x = 0$ because $f'(0)$ d.n.e.

| | $0 - \varepsilon$ | $0 + \varepsilon$ | $\frac{3}{2} - \varepsilon$ | $\frac{3}{2} + \varepsilon$ |
|---|---|---|---|---|
| $f'$ | $+$ | $+$ | $+$ | $-$ |
| $f$ | $\nearrow$ | $\nearrow$ | $\nearrow$ | $\searrow$ |

$x = 0$ no extrema

$x = 3/2$ is max.

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Panel 9

$$f'(x) = \frac{3}{5}x^{-2/5}(4-x) + x^{3/5}(-1) =$$

$$= \frac{3(4-x)}{5x^{2/5}} - x^{3/5} = \frac{3(4-x) - 5x}{5x^{2/5}} = \frac{12-8x}{5x^{2/5}}$$

$x = -1$ : $\frac{+}{+}$

$x = 1$ : $+$

$x = \pm 10\,000\,000$ : $-$

$$x^{2/5} = \sqrt[5]{x^2}$$

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Panel 10

How to find absolute extremes:

On Monday

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