September 19, 2025

Talk Like a Pirate Day

Today in History:

Nevada is site of first underground nuclear explosion (1957)

President Garfield dies (1881)

Number of the Day: 5276

5276 = 2 x 2 x 1319

5276 cannot be written as a sum of three squares.

Fun Fact:

A slug has four noses.

Quote of the Day:

"Grief is the price we pay for love."

— Queen Elizabeth II

Today's Weather:

Partly cloudy. High 74°

Math 121

Quiz #12

Use the definition of derivative to find $f'(4)$ for

$$f(x) = \sqrt{x}$$

$$f'(4) = \lim_{h \to 0} \frac{f(4+h) - f(4)}{h}$$

$$= \lim_{h \to 0} \frac{\sqrt{4+h} - 2}{h} \cdot \left(\frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} \right)$$

$$= \lim_{h \to 0} \frac{\cancel{4} + \cancel{h}^{\,1} - \cancel{4}}{\cancel{h}(\sqrt{4+h} + 2)} = \frac{1}{4}$$

TEST 1

HIGH	100 (9)		90–100	227
AVE	85.32		80–89	150
MED	87		70–79	86
			60–69	32
			50–59	10
			↓	3

1a) $a = 10, \ b = 3$

b) 9

c) $y - 1 = \frac{4}{7}(x - 2)$

d) STUFF

2a) $\cos\theta = -.8 \qquad \tan\theta = -.75$

b) $f^{-1}(x) = \dfrac{2}{x-3}$

c) C

d) $e \quad (\pm e)$

3 a) 0

b) -1

c) $\frac{1}{2}$

d) $-\frac{1}{4}$

4 a) 2

b) 0

c) $-\frac{8}{3}$

d) $a = 1, \ b = 2$

(4)(b) $\lim_{x \to 0} x^2 \cos\left(\frac{1}{x^2}\right) = 0$

$$-1 \le \cos\left(\frac{1}{x^2}\right) \le 1$$

$$\underbrace{-x^2}_{\to 0} \le x^2 \cos\left(\frac{1}{x^2}\right) \le \underbrace{x^2}_{\to 0}$$

(5) F, T, F, T, F, T, T, F, F, T

(4d)

$$f(x) = \begin{cases} ax^2 + b & x < 1 \\ 3 & x = 1 \\ 2x + a & x > 1 \end{cases}$$

$\lim_{x \to 1^-} f(x) = a + b$ $\lim_{x \to 1^+} f(x) = 2 + a$

$\cancel{a} + b = 2 + \cancel{a}$

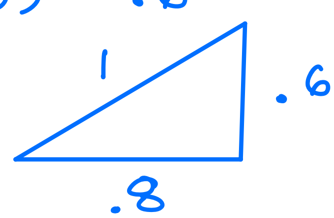
$$\boxed{\begin{aligned} b &= 2 \\ a &= 1 \end{aligned}}$$

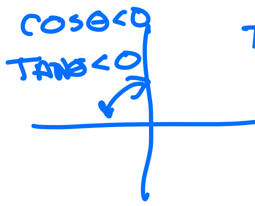
$\lim_{x \to 1} f(x) = f(1) = 3$

$a + b = 3$

$2 + a = 3$

(2a) $\sin(\theta) = .6$ $\cos\theta = -.8$

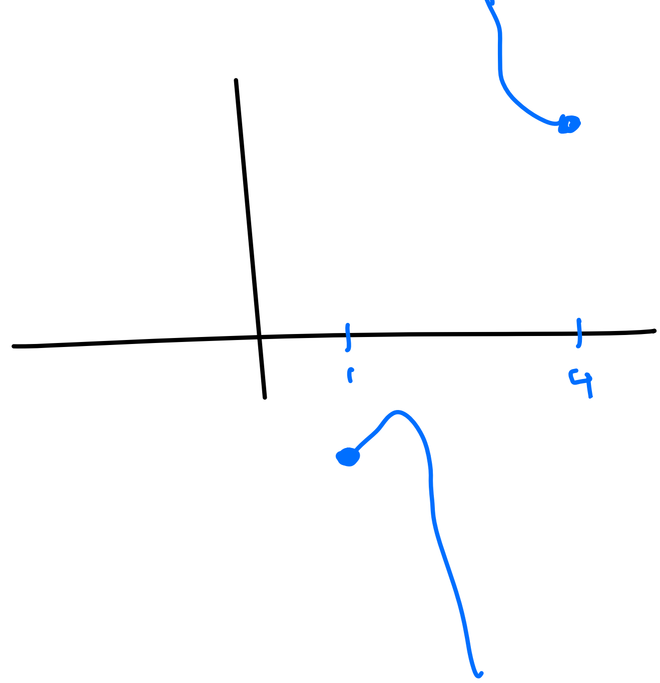




$\tan\theta = \frac{-.6}{.8}$

$= -.75$

5e



5b

3d $$\lim_{x\to 1} \frac{2-\sqrt{x+3}}{x-1}\left(\frac{2+\sqrt{x+3}}{2+\sqrt{x+3}}\right)$$

$$= \lim_{x\to 1} \frac{\overset{1}{\cancel{4}} - (x+\cancel{3})}{(x-1)(2+\sqrt{x+3})} = \lim_{x\to 1} \frac{\overset{-1}{\cancel{1-x}}}{\cancel{(x-1)}(2+\sqrt{x+3})}$$

$$= \frac{-1}{4}$$

RULES

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

① CONSTANT RULE

$$f(x) = C \qquad\qquad f'(x) = 0$$

② POWER RULE

$$f(x) = x^N$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \to 0} \frac{(x+h)^N - x^N}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{x^N} + N x^{N-1} \cancel{h} + \frac{(N)(N-1)}{2} x^{N-2} h^{\cancel{2}} + \dots h^{\overset{N-1}{\cancel{N}}} - \cancel{x^N}}{\cancel{h}}$$

$$= \lim_{h \to 0} N x^{N-1} + \frac{N(N-1)}{2} x^{N-2} h + \dots h^{N-1}$$

$$= N x^{N-1}$$

$$f(x) = x^N \qquad\qquad f'(x) = N x^{N-1}$$

③ CONSTANT MULT. RULE

$$f(x) = c\, g(x) \qquad\qquad f'(x) = c\, g'(x)$$

④ SUM RULE

$$s(x) = f(x) \pm g(x) \qquad\qquad s'(x) = f'(x) \pm g'(x)$$

(5) EXPONENTIAL RULE

$$f(x) = b^x$$

$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h\to 0} \frac{b^{x+h} - b^x}{h}$$

$$= \lim_{h\to 0} \frac{b^x b^h - b^x}{h}$$

$$= \lim_{h\to 0} \frac{b^x (b^h - 1)}{h}$$

$$= b^x \underbrace{\lim_{h\to 0} \frac{b^h - 1}{h}}$$

$b=2$ $\quad$ $b=3$

<1 $\quad$ >1

$$\lim_{h\to 0} \frac{b^h - 1}{h} = 1$$

$$b = 2.718281828459\ldots = e$$

$$\lim_{h\to 0} \frac{e^h - 1}{h} = 1$$

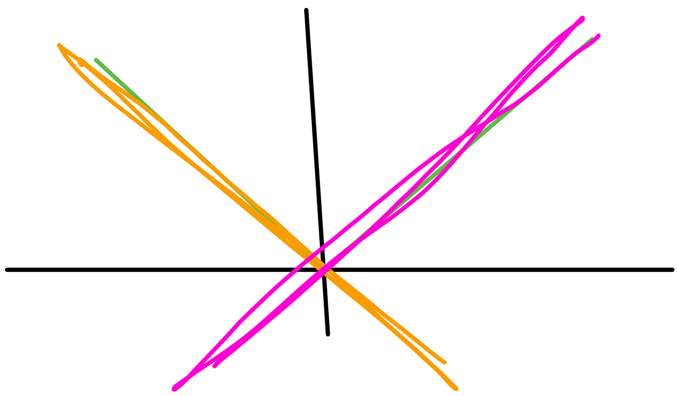
$$e^x \lim_{h \to 0} \frac{e^{h-1}}{h} = e^x$$

$f(x) = e^x$ $\qquad$ $f'(x) = e^x$

WHEN IS THERE A DERIVATIVE?

$f(x)$ IS NOT CONT. AT a $\qquad$ $f'(a)$ D.N.E.

$f(x) = |x|$



$$f'(0) = \lim_{h \to 0} \frac{f(0+h) - f(0)}{h}$$

$$= \lim_{h \to 0} \frac{|h|}{h} = \text{DNE}$$

$$\lim_{h \to 0^+} \frac{|h|}{h} = 1 \qquad \lim_{h \to 0^-} \frac{|h|}{h} = 1$$