Counting Buses

Homework

#24.5
Midterm
corrections

1. What is Calculus?

   The study of change

   What is "the derivative" in other words?

   the line of the tangent

   Where can calculus be useful?

   to find instantaneous rate, max + min, square roots,
   differentials

   What is zero times infinity?

   undefined, can be anything depending on the situation

$S(P) = .51P^2 - 3$

DGX

$\boxed{\#2}$

a) $P(0) = -3$

$P(8) = 29.64$

$\frac{29.64 - -3}{8-0} = 4.08$ Average

b) $y = .51P^2 - 3$

$y' = 1.02P$

$y'(4) = 1.02(4) = 4.08$ = Instant at $P = 4$

c) If $S(0) = -10$ and $S(P_0) = 16$, Is there a Price when $S(P) = 0$?

Yes, because of the Intermediate value theorem. The function must be continuous.

Double Helix

#3 Find the equation of a tangent line @ point $x = 27$ for $f(x) = \sqrt[3]{x}$

a) $y = \sqrt[3]{x} \Rightarrow$ 2nd trace $(27, 3)$

$m = f'(27)$

$f(x) = \sqrt[3]{x}$

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

$f'(27) = \frac{1}{3}(27)^{-2/3}$

$m = \frac{1}{3} \cdot \frac{1}{9} = \frac{1}{27}$

$y - 3 = \frac{1}{27}(x - 27)$

$y = \frac{1}{27}(x - 27) + 3$

$y(26) = \frac{1}{27}(26 - 27) + 3$

$y = \frac{1}{27}(-1) + 1$

b) approximate the cubed root of 25

$f(x) = \sqrt[3]{x}$

$f'(x)$ [illegible]

$f'(25) = \frac{1}{3}(25)^{-2/3}$

$x = 3$

$\sqrt[3]{27} \approx \sqrt[3]{26}$

Deutsche Produktion

Robin Patton
Jana Wolf
Hiroaki Tanicke
Samuel Cankan

Midterm 14

a) $\lim_{x \to 4} \frac{x^2-16}{x-4}$ = use L'Hospital rule

$= \frac{2x}{1} = \lim_{x \to 4} \frac{2 \cdot 4}{1} = \underline{\underline{8}}$

↳ What does the graph $y = \frac{x^2-16}{x-4}$ look like at $x=4$?

$x-4 = 4-4 = 0$

↳ It is removable discontinuous, there is a hole since both the numerator and the denominator equal 0 at $x=4$.

b) $\lim_{x \to 0^-} \frac{\sin(7x)}{6\cos x - 6} = \frac{0}{0}$ use L'Hospital rule

$= \lim_{x \to 0^-} \frac{7\cos(7x)}{6(-\sin(x))}$

$= \lim_{x \to 0^-} \frac{7\cos(7x)}{-6\sin(x)}$ $\frac{1}{0}$ undefined

$= \underline{\underline{-\infty}}$

INVESTMENT BANKERS

5.

a) $g(s) = e^{x} \cos(x)$

$g'(s) = \frac{d}{dx} e^{x} \cdot \cos(x) + e^{x} \cdot \frac{d}{dx} \cos(x)$

$g'(s) = e^{x} \cdot \cos(x) + e^{x} \cdot -\sin(x) \frac{d}{dx} x$

$g'(s) = e^{x} \cos(x) + e^{x}(-\sin(x)) \cdot 1$

PRODUCT AND CHAIN RULE

b) $k(t) = \tan(\sin^{-1}(t))$

$k'(t) = \frac{d}{dx} \tan(\sin^{-1}(t))$

$k'(t) = \sec^{2}(\sin^{-1}(t)) \cdot \frac{d}{dx} \sin^{-1}(t)$

$k'(t) = \sec^{2}(\sin^{-1}(t)) \cdot \frac{1}{\sqrt{1-(t)^2}} \cdot \frac{d}{dx}(t)$

$k'(t) = \sec^{2}(\sin^{-1}(t)) \cdot \frac{1}{\sqrt{1-t^2}} \cdot 1$

6)

$$y = x^2 + 3\cos y$$

a)

$$\frac{dy}{dx}' = 2x + -3\sin y \frac{dy}{dx}$$

$$\frac{dy}{dx} + 3\sin y \frac{dy}{dx} = 2x$$

$$\frac{dy}{dx}(1 + 3\sin y) = 2x$$

$$\frac{dy}{dx} = \frac{2x}{1+3\sin y}$$

b)

$$y = t^{2t}$$

$$\ln y = \ln t^{2t}$$

$$\underline{\ln y = 2t \ln t} \quad \text{take } \frac{d}{dx} \text{ both sides}$$

$$\frac{1}{y} y' = 2t \cdot \frac{1}{t} + 2 \cdot \ln t$$

$$\frac{1}{y} y' = 2 + 2\ln t$$

$$y' = y(2 + 2\ln t)$$

$$= t^{2t}(2 + 2\ln t)$$

Purple Parrots

7. $R(p) = 200p(180 - p^2)$ $\qquad \frac{dp}{dt} = 10 \quad p = 8$

$R(p) = 36,000p - 200p^3$

$R'(p) = 36,000\frac{dp}{dt} - 600p^2\frac{dp}{dt}$

$R'(p) = 36,000(10) - 600(8)^2(10)$

$R'(p) = 360,000 - 600(64)(10)$

$R'(p) = 360,000 - 384,000$

$R'(p) = \frac{dr}{dt} = -24,000$

max: graph → 2^{nd} calc → max → left = 0 → right = 12 → enter

$x = 7.7459669$

min: graph → 2^{nd} calc → min → left = 0 → right = 13.416408

$x = 13.416408$ & 0

Timothy Lukowicz
Abraham Sherman

8) $y = 3x^2 - 5x$

$$y' \lim_{h\to 0} = \frac{[3(x+h)^2 - 5(x+h)] - [3(x)^2 - 5(x)]}{h}$$

$$y' \lim_{h\to 0} = \frac{[\cancel{3x^2} + 6xh + 3h^2] - [\cancel{5x} + 5h]) - (\cancel{3x^2} - \cancel{5x})}{h}$$

$$y' \lim_{h\to 0} = \frac{6x\cancel{h} + 3h^{\cancel{2}} - 5\cancel{h}}{\cancel{h}}$$

$$y' \lim_{h\to 0} = 6x + 3(0) - 5$$

$$y' = 6x - 5$$

$$\lim_{x\to 2} 3x - 5$$

$$\lim_{x\to 2} |f(x) - L| < \varepsilon$$

$$|3x - 5 - 1| < \varepsilon$$

$$|3x - 6| < \varepsilon = \delta$$

$$3|x - 2| < \frac{\varepsilon}{3} = \delta$$

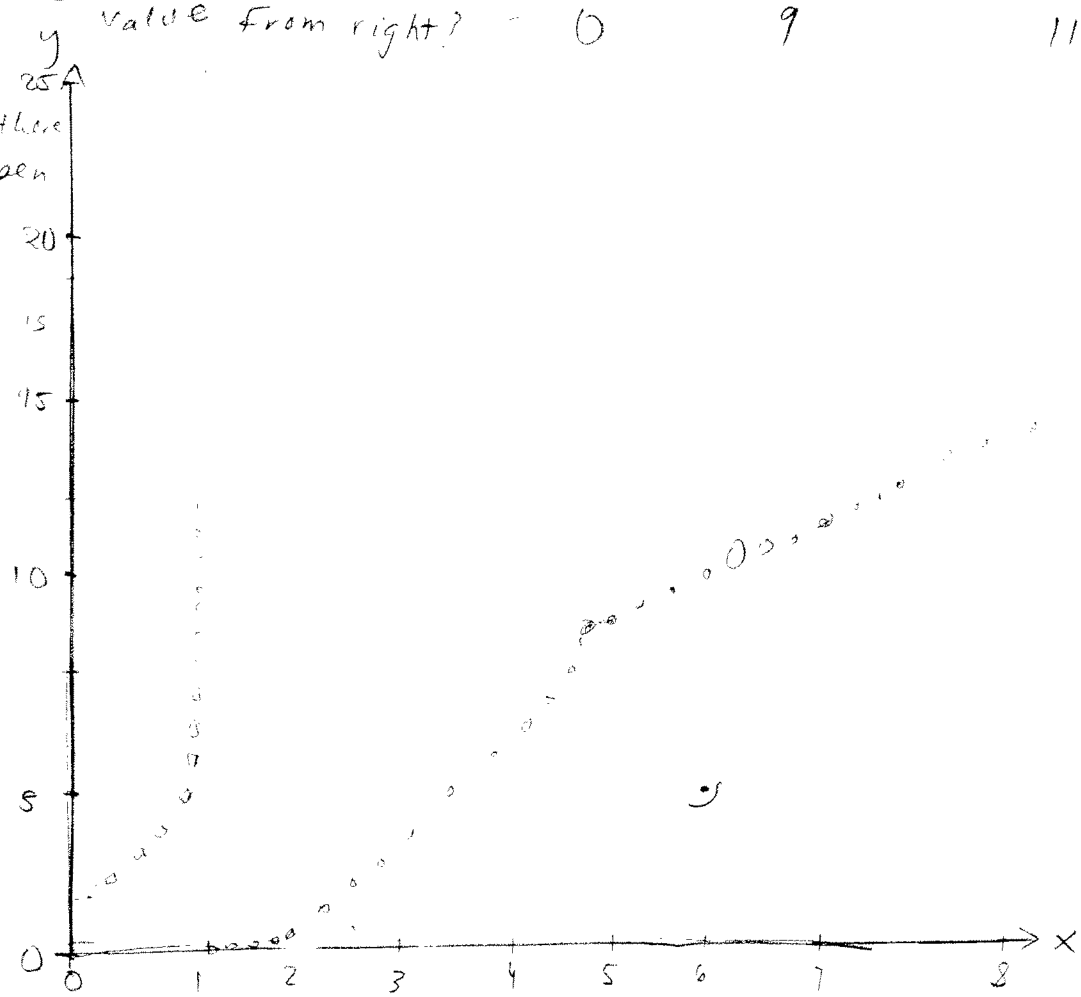
$$|x - 2| < \frac{\varepsilon}{3} = \delta$$

Abraham Sherman   Timothy Lukowicz

9) Fill in the table below by using the graph

	$x=1$	$x=4$	$x=6$
$F(x)$ is Continuos Y/N	No	Yes	no
$F(x)$ is Differtiable? Y/N	No	No	No
What is the limit value from right?	0	9	11

ASSum there is an open hole at $x=6$ and the function is defined to be yes



PURPLE [illegible]

10)

Stat
Edit → [illegible]

L_1	L_2
1	200
3	400
5	100
7	800

$y = 31.250\ldots x^3 - 343.750\, x^2 + 1068.750\ldots x - 556.250\ldots$

$2 \xrightarrow{\text{sto}} X$

$y = X - y_1 / \text{nderiv}(y_1, X, X) \rightarrow X$

-0.4678492409
0.3363832435
0.6128235004
0.6468076358
0.6473042896
0.6473043949

Stat → calc
6: cubic Reg → enter
y=
Vars
[illegible] → EQ
1. RegEQ

2nd [illegible]
([illegible])
[illegible] min
[illegible]

11) $y = x^3 - 27x$

a) $y' = 3x^2 - 27 = 0$

$x^2 - 9 = 0$

$x = 3, -3$

Crit. values

3, -3

$y'' = 6x$

$y''(3) = 6 \cdot 3 = 18 \oplus$ MIN.

$y''(-3) = 6(-3) = -18 \ominus$ MAX

$3 \to$ MIN

$-3 \to$ MAX

b) $y'' = 6x = 0$

$x = 0.$

Inflect $(0, 0)$

c) $y(-1) = -1 + 27 = 26$

$y(4) = 64 - 27 \cdot 4 = -44$ NOT MAX

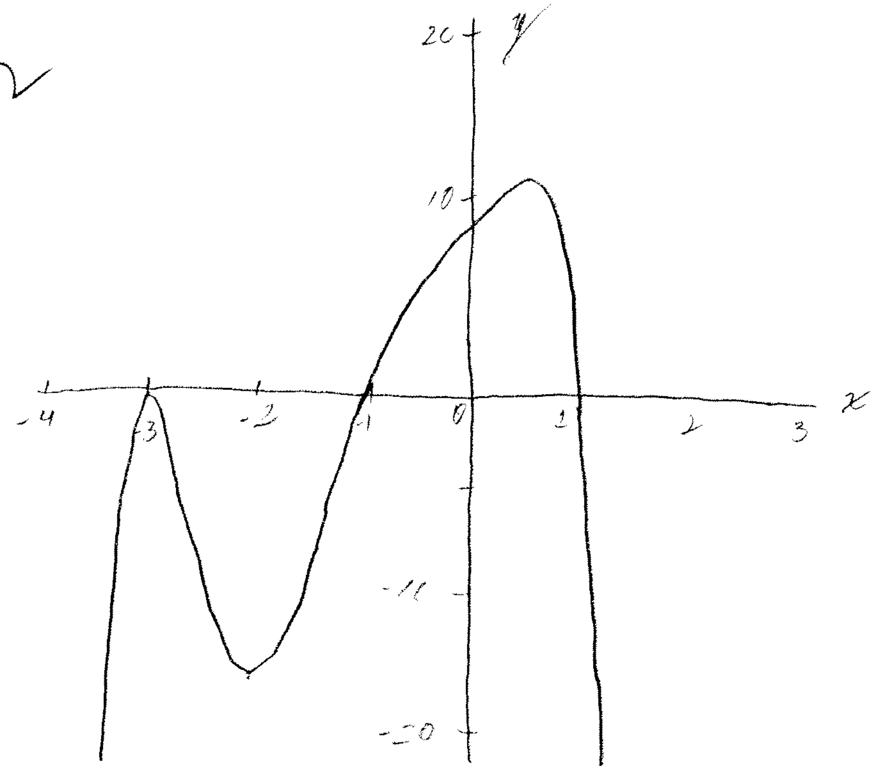
$$\begin{array}{r} 108 \\ 64 \\ \hline 44 \end{array}$$

$y(3) =$ MIN from above.

What is max = 26

INVESTMENT BANKERS

12



- When is the function concave up?

$(x = -2.5 \cup x = -1.5)$

- Where is an inflection point?

$x = -2.5,\ x = -1.5$

- Where are the extrema?

LOCAL MIN: $(-2, -15)$ LOCAL MAX: $(0.5, 10)$, $(-3, 0)$

- When is the function decreasing and concave up?

$(x = -3, \cup\, x = -2.5) \cup (x = 0.5, \cup\, \infty)$