little long allowed 23 min
all but 25+
but were willing to leave by 29

MATH 131
Quiz III
October 14, 1993

Name Key

$\bar{X}$ 18.9/30
m 18.5
10

1. Find $\frac{dy}{dx}$ when $x^3 + xy + xy^2 = \sin x$

$$3x^2 + x\frac{dy}{dx} + y + x\,2y\frac{dy}{dx} + y^2 = \cos x$$

$$x\frac{dy}{dx} + 2xy\frac{dy}{dx} = \cos x - y^2 - 3x^2 - y$$

$$\frac{dy}{dx} = \frac{\cos x - y^2 - 3x^2 - y}{x + 2xy}$$

2. Find the linear approximation L(x) for $f(x) = x + \tan x$ at $x = \frac{\pi}{4}$.

too hard

$$\frac{dy}{dx} = 1 + \sec^2 x = 1 + \frac{1}{\cos x}^2 = 3$$

$$f\left(\frac{\pi}{4}\right) = \frac{\pi}{4} + 1$$

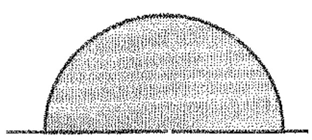
$$y - \left(1 + \frac{\pi}{4}\right) = 3\left(x - \frac{\pi}{4}\right) \qquad y = 2x - \frac{3\pi}{4} + 1 + \frac{\pi}{4}$$

$$= 2x + 1 - \frac{\pi}{2}$$

1.78

3. Oil from a pipeline on shore is leaking into the ocean and forming a semicircular oil slick. The area of the slick is increasing ar the rate of 10 sq yd. per hour. When the radius of the slick is 200 yds, how fast is the radius changing?

17



$$a = \frac{1}{2}\pi r^2$$

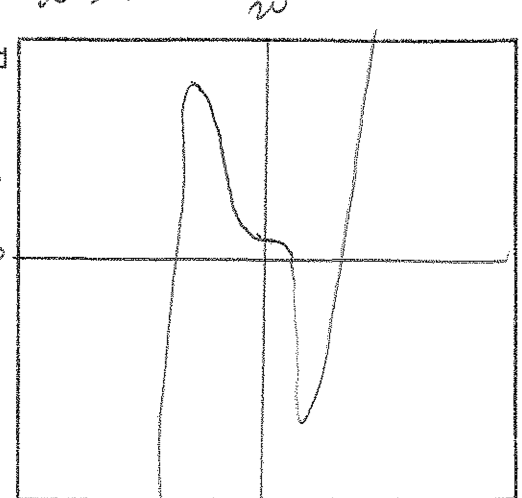
$$da = \frac{1}{2}\,2\pi r\frac{dr}{dt}$$

$$10 = \pi(200)\frac{dr}{dt}$$

$$\frac{dr}{dt} = \frac{10}{200\pi} = \frac{1}{20\pi} \text{ yd/hr}$$

.015 9

4. $f(x) = x^5 - 6x^3 + 2$, sketch the graph, show x and y ranges. Analytically find relative maxima, minima, points of inflection. Give intervals on which f is increasing, decreasing, and where the graph is concave up, down.



7
must
10 close

$$f' = 5x^4 - 18x^2 \qquad x^2(5x^2 - 18)$$

$$f'' = 20x^3 - 36x \qquad 4x(5x^2 - 9)$$

C.P $x = 0, \pm\sqrt{\frac{18}{5}}$

P.I $x = 0, \pm\sqrt{\frac{9}{5}}$

I $\left(-\infty, -\sqrt{\frac{18}{5}}\right), \left(\sqrt{\frac{18}{5}}, \infty\right)$

D $\left(-\sqrt{\frac{18}{5}}, \sqrt{\frac{18}{5}}\right)$

Max $x = -\sqrt{\frac{18}{5}}$

min $x = +\sqrt{\frac{18}{5}}$

CC ↑ $\left(-\sqrt{\frac{9}{5}}, 0\right)$ $\left(\sqrt{\frac{9}{5}}, \infty\right)$

CC ↓ $\left(-\infty, -\sqrt{\frac{9}{5}}\right)$ $\left(0, \sqrt{\frac{9}{5}}\right)$