No Calculator Part:

(1)

$$V = \frac{1}{3}\pi r^2 h$$

$$\frac{dV}{dT} = \frac{1}{3}\pi\left[r^2\frac{dh}{dT} + 2rh\frac{dr}{dT}\right]$$

$$\frac{dh}{dT} = \frac{dr}{dT} = \frac{1}{2}$$

$\frac{dV}{dT}$

$h = 9$

$r = 6$

$$\frac{1}{3}\pi\left[36\left(\frac{1}{2}\right) + 2(6)(9)\left(\frac{1}{2}\right)\right]$$

$$\frac{\pi}{3}[18 + 54]$$

$$\frac{\pi}{3}[72]$$

24π C

(2)

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

$y(-1) = -1 + 3 + 2 = 4$

$y' = 3x^2 + 6x$

$y'(-1) = 3(-1)^2 + 6(-1)$

$3 - 6 = -3$

$y'' = 6x + 6$

$0 = 6x + 6$

$-1 = x$

$y - 4 = -3(x + 1)$

$y - 4 = -3x - 3$

$y = -3x + 1$

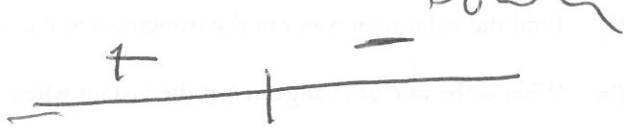
B

(3) $y = -\frac{5}{x-2}$ $\quad -5(x-2)^{-1}$

$5(x-2)^{-2}$

$y' = \frac{5}{(x-2)^2}$ $\quad -10(x-2)^{-3}$

$y'' = \frac{-10}{(x-2)^3}$



~~$(-\infty, 2)$~~ ~~B~~ C

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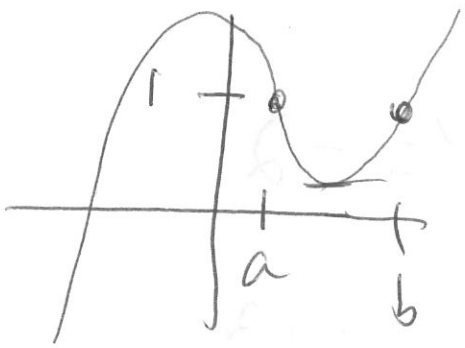
(4)



II C

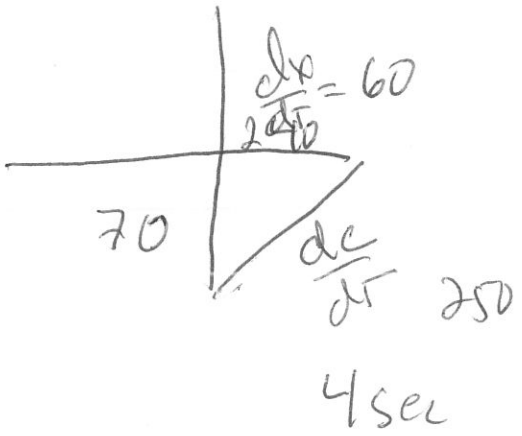
Name_____

Section I, Part B
Time-9 minutes Number of questions – 3
A GRAPHING CALCULATOR IS REQUIRED FOR SOME QUESTIONS ON THIS PART OF THE EXAMINATION
(Worth 30% of Exam)

Directions: Solve each of the following problems, using the available space for scratch work. After examining the form of the choices, decide which is the best of the choices given. Clearly mark your selection.

1. A railroad track and a road cross at right angles. An observer stands on the road 70 meters south of the crossing and watches an eastbound train traveling at 60 meters per second. At how many meters per second is the train moving away from the observer 4 seconds after it passes through the intersection?

(A) 57.60 (B) 57.88 (C) 59.20 (D) 60.00 (E) 67.40



$70^2 + x^2 = c^2$

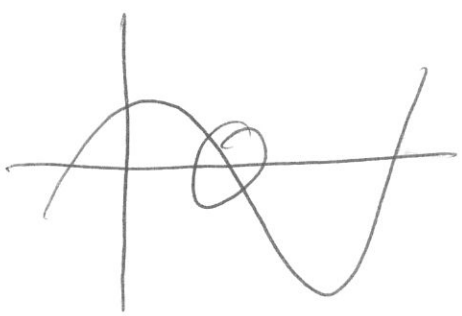
$2x\frac{dx}{dt} = 2c\frac{dc}{dt}$

$2(240)(60) = 2(250)\frac{dc}{dt}$

2. If the derivative of f is given by $f'(x) = e^x - 3x^2$, at which of the following values of x does f have a relative maximum value?

(A) -0.46 (B) 0.20 (C) 0.91 (D) 0.95 (E) 3.73

$e^x - 3x^2 = 0$



Name_____

3. Suppose the revenue, in dollars, for producing x chairs is given by $r(x)=50x$ and the cost to produce the chairs is given by $c(x)=0.001x^3-0.1x^2+12x+1500$. Find the production level that will maximize the profit.

(a) 37 chairs (b) 123 chairs (c) 151 chairs (d) 235 chairs (e) Not here, or does not exist

$r(x) - c(x) = \text{Profit}$

$P' = 0$ @

3.

Name_____

AP Calculus

Section II

Time 30 minutes Number of problems 2
Percent of total grade-50

A GRAPHING CALCULATOR IS REQUIRED FOR SOME PROBLEMS OR PARTS OF PROBLEMS ON THIS SECTION OF THE EXAMINATION.

REMEMBER TO SHOW YOUR SETUPS AS DESCRIBED IN THE GENERAL INSTRUCTIONS

1. Let $f(x)=x^3+ax^2$. What is the value of a if:
   a. f has a local minimum at x = 4?
   b. f has a point of inflection at x = 6?

$f'(x) = 3x^2 + 2ax \qquad x = 4$

$0 = 48 + 8a$

$-6 = a$

CK

$f'(x) = 3x^2 - 12x$

$3x(x-4)$

+ | − | +

0 4

a min ✓

(b) $f''(x) = 6x + 2a \qquad x = 6$

$0 = 36 + 2a$

$-18 = a$

$6x - 36 = 0 \quad 6(x-6)$

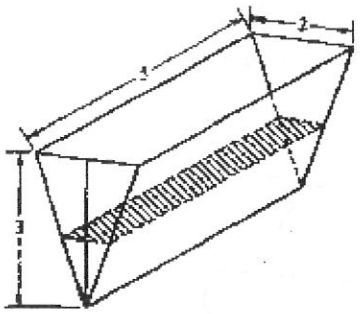
− | +

6

Concavity Change ✓

Name_____

2. 1987- AB5



The trough shown in the figure above is 5 feet long, and its vertical cross sections are inverted **isosceles triangles** with base 2 feet and height 3 feet. Water is being siphoned out of the trough at the rate of 2 cubic feet per minute. At any time t, let *h* be the depth and V be the volume of water in the trough.

(a) Find the volume of water in the trough when it is full.

(b) What is the rate of change in *h* at the instant when the trough is ¼ full by volume?

(c) What is the rate of change in the area of the surface of the water (shaded in the figure) at the instant when the trough is ¼ full by volume?

$V = \frac{1}{2}\,2(3)(5) = 15$ cu. ft.

(b) $\frac{2}{3} = \frac{b}{h}$ wants $\frac{dh}{dT}$ $b = \frac{2}{3}h$

$V = \frac{1}{2}\left(\frac{2}{3}h\right)h$

$V = \frac{1}{3}h^2$

$\frac{dV}{dT} = \frac{2}{3}h\frac{dh}{dT}$

$-2 = \frac{2}{3}\cdot\frac{3}{2}\sqrt{5}\frac{dh}{dT}$

$\frac{dh}{dT} = -\frac{2}{\sqrt{5}}$

$\frac{dV}{dT} = -2$

$\frac{15}{4} = \frac{1}{2}h^2$

$\frac{45}{4} = h^2$

$\sqrt{\frac{45}{4}} = h = \frac{3}{2}\sqrt{5}$