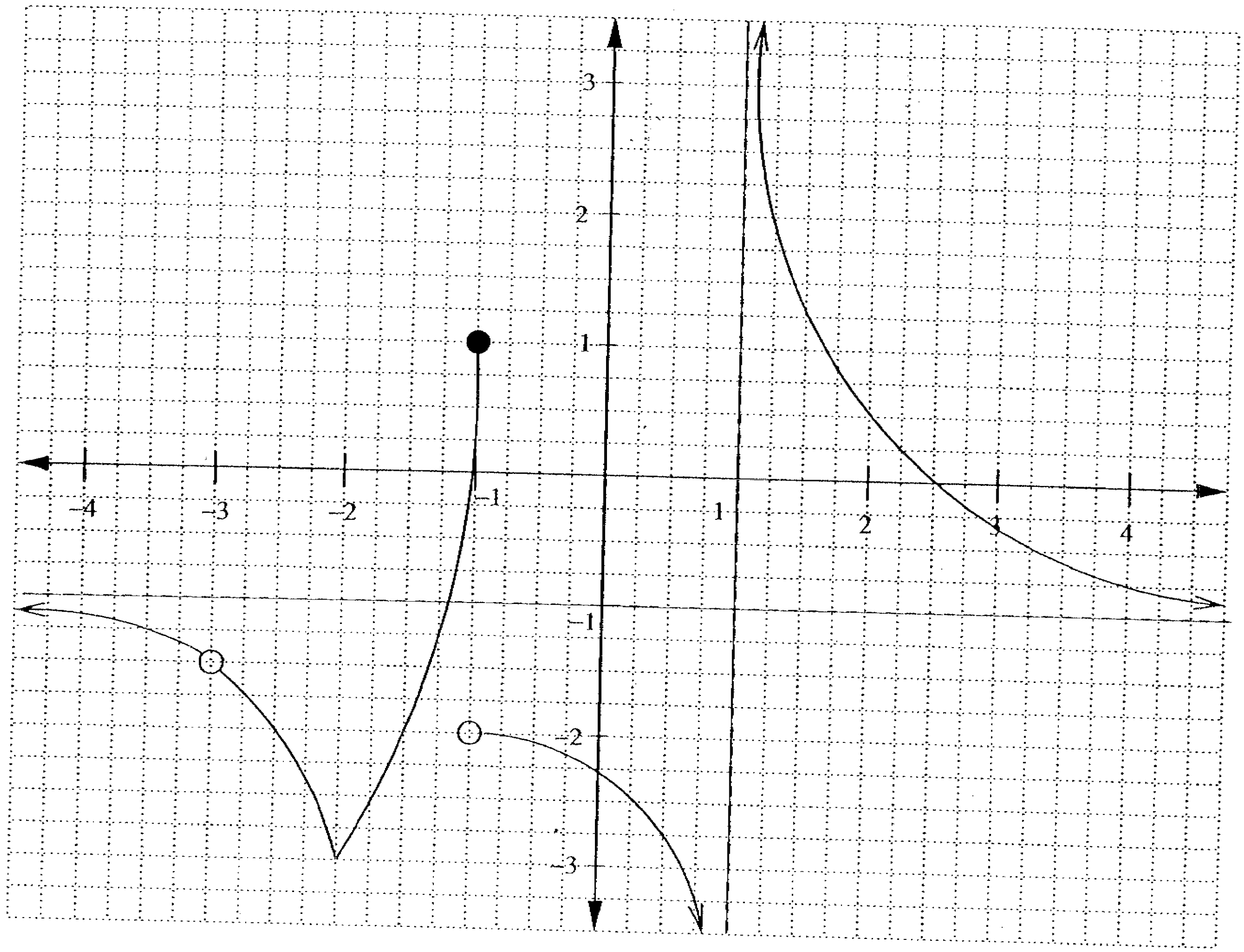
Name:______________________

Part I: Each question is worth 2 points. Just record your final answer.
In problems 1-7, answer the questions using the graph of $f(x)$. Use ∞ or $-\infty$ or DNE (does not exist) where appropriate.



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

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

3. $f(-1) =$________________

4. $\lim_{x \to 1^-} f(x) =$________________

5. $\lim_{x \to -1} f(x) =$________________

6. Is $f(x)$ differentiable at x=-2?________________

7. For what values of x is $f(x)$ not continuous?________________

8. Write the equation of the horizontal asymptote.________________

9. If $g(x) = \dfrac{4x^2 - 3}{x^2 - 2x - 3}$ then the equations of the vertical asymptotes are: $x =$______ and $x =$______

In problems 10 and 11, evaluate the derivative.

10. If $f(x) = (2x - 1)^3$ then $f'(x) =$____________________

11. $\dfrac{d}{dx}\left[e^x - ln(3x)\right] =$________________

Answer questions 12 and 13 assuming that:
The domain of $h(x)$ is all real x
$h'(x) < 0$ on $(-\infty, -2)$ and $(4, \infty)$
$h'(x) > 0$ on $(-2, 4)$
$h''(x) > 0$ on $(-\infty, 1)$ and $h''(x) < 0$ on $(1, \infty)$

12. List the critical numbers of $h(x)$. x=____________________

13. List all intervals for which $h(x)$ is concave down. ____________________

14. Evaluate the limit: $\lim_{x \to 2} \dfrac{x - 2}{x^2 - 4} =$________________

15. If \$5000 is invested at 8% and compounded continuously, how long will it take to double? (Round your answer to 2 decimal places.)

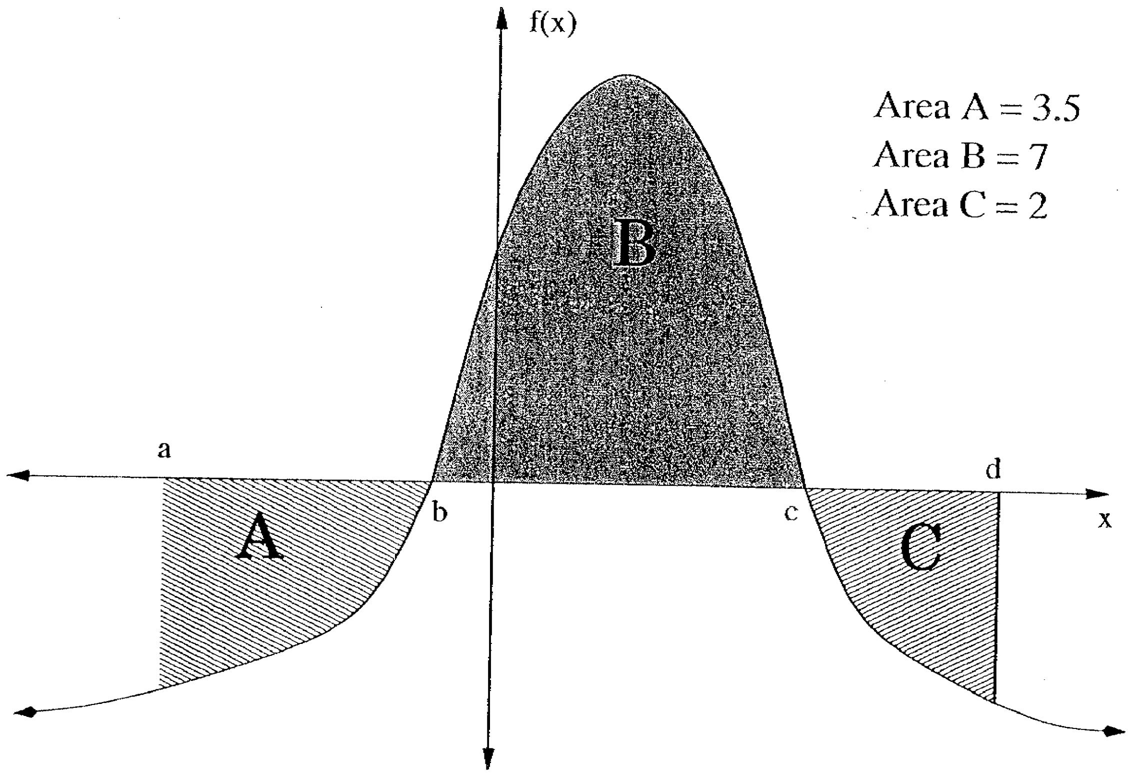
____

In problems 16 and 17 evaulate the integrals.

16. $\int 4t^3 + e^t dt =$____________________

17. $\int (2x^{-2} + x^{-1})dx =$____________________

Problems 18, 19, and 20 refer to the following figure with the indicated areas:



18. $\int_b^c f(x)\,dx =$ ________________

19. $\int_a^d f(x)\,dx =$ ________________

20. Set up a definite integral that will represent the shaded area over the interval $[a, c]$:

____

Part II: 4 points each. For credit, you must show all of your work.

21. Find $f'(x)$ for $f(x) = e^{x^2} \cdot (x^2 - 6)^5$. You do not need to simplify.

22. Given $f(x) = \dfrac{5x+1}{4-7x^2}$ find $f'(x)$. Simplify your answer.

23. Use u substitution to find $\int \frac{1}{x^2} e^{-2/x} dx$.

A. $u =$

B. $du =$

C. Final answer (in terms of x):

24. $\int_{4}^{25} \frac{4}{\sqrt{x}} dx =$

25. Find the area bounded between the two equations: $f(x) = -x^2 + 10$ and $g(x) = 2x + 7$.

Part III: Each problem is worth 10 points. For credit, you must show all of your work.

26. For this problem, refer to the function:

$$f(x) = \frac{1}{3}x^3 + x^2 - 8x - 5$$

A. $f'(x) =$

B. Find the critical values.

C. Using a sign chart and appropriate test numbers, find the increasing and decreasing intervals of $f(x)$ and the local extrema.

increasing intervals: ______________________ decreasing intervals: ______________________

the local Max is: ______________________ when $x =$ ______________________

the local Min is: ______________________ when $x =$ ______________________

D. $f''(x) =$

E. Find the inflection point of $f(x)$.

F. Find the interval where $f(x)$ is concave up ______________________

and the interval where $f(x)$ is concave down ______________________

27. The rate of change of the monthly sales of a new video game cartridge is given by:

$$S'(t) = 500t^{1/4} \qquad S(0) = 0$$

where t is the number of months since the game was released and $S(t)$ is the number of cartridges sold each month.

A. Find $S(t)$ by setting up an indefinite integral and finding the particular antiderivative.

$S(t) =$____________________

B. Find $S(16)$ and interpret the results.

C. When will the monthly sales reach 20000 cartridges?

28. A small business has \$20 as unit cost and \$15000 as fixed cost. The price-demand equation is: $p = 150 - 0.2x$ with the domain $0 \leq x \leq 750$.

A. Find the Revenue equation $R(x)$.

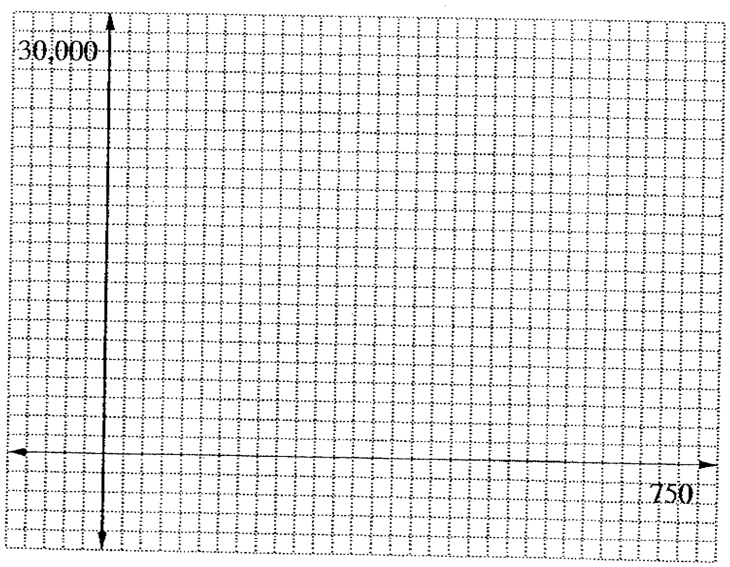
B. Find the value for x that will maximize the revenue.

C. Find the maximum revenue.

D. What is the price that corresponds to the maximum revenue?

E. Find the equation that represents the cost $C(x)$.

F. Graph the revenue and cost functions and label it correctly. Be sure to include the regions of profit, loss, and where the break-even points occur.



29. Suppose that the price-demand equation is given by: $p = 7 - ln(x)$ where $0 < x \leq 100$. x is in thousands, p is in dollars, and the cost of manufacturing is $2 per item.

A. Find the profit equation $P(x)$.

B. Find the production that maximizes the maximum profit.

C. Find the max profit.

D. Find the price that corresponds to the maximum profit.

E. Using the profit function, find the equation of the tangent line when $x = 1$.

POLYNOMIAL CALCULUS (1080) **NOTE SHEET FOR EXAMS**

CHAPTER 8

1. $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$ Derivative of f at x, instantaneous rate of change and the slope of the tangent line

2. Point slope form for the equation of a line. $y - y_1 = m(x - x_1)$ *or* $y = m(x - x_1) + y_1$

3. Product Rule: If $y = f(x) = F(x)S(x)$ *then* $y' = FS' + SF'$

4. Quotient Rule: *If* $y = f(x) = \frac{T(x)}{B(x)}$ *then* $y' = \frac{BT' - TB'}{B^2}$

5. General Power Rule: *If* $y = [u(x)]^n$ *then* $y' = nu^{n-1}u'$

6. The word *marginal* refers to an instantaneous rate of change--that is, a derivative.

7. Revenue = x (#of items) times price Profit = revenue - cost

8. Break-even points: Where the Revenue and Cost are equal.

CHAPTER 9

1. Increasing and Decreasing Functions

f'(x)	f(x)
+	Increases
-	Decreases

First Derivative Test (Local Extrema)

Let c be a critical value of f

a) if f'(c) changes from negative to positive at c, then f(c) is a local Min.

b) if f'(c) changes from positive to negative at c, then f(c) is a local Max.

2. Second-Derivative Test
Let c be a critical value for f(x)

f'(c)	f"(c)	Graph of f is:	f(c)
0	+	Concave up	Local minimum
0	-	Concave down	Local maximum
0	0	Test Fails	

3. Asymptotes

y = b is a <u>horizontal asymptote</u> if $\lim_{x \to -\infty} f(x) = b$ *or* $\lim_{x \to \infty} f(x) = b$

Let $f(x) = \frac{n(x)}{d(x)}$, where both n and d are continuous at x=c. If, at x=c, the denominator d(x) is 0 and the numerator n(x) is not 0, then the line x = c is a <u>vertical asymptote</u> for the graph of f.

4. The minimum average cost occurs when the average cost is equal to the marginal cost.

CHAPTER 10

1. **Continuous Compound Interest Formula.** $A = Pe^{rt}$

2. **General Defivative Rules**

   a) $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} f'(x)$

   b) $\frac{d}{dx}\ln[f(x)] = \frac{1}{f(x)} f'(x)$

   c) $\frac{d}{dx}e^{f(x)} = e^{f(x)} f'(x)$

CHAPTER 11

1. **Indefinite Integral Formulas and Properties. For k and C constants**

   1) $\int k \ dx = kx + C$

   2) $\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$

   3) $\int kf(x)dx = k\int f(x)dx$

   4) $\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)dx$

   5) $\int e^x dx = e^x + C$

   6) $\int \frac{1}{x} dx = \ln|x| + C$

2. **Definite Integral Symbol for Functions with Negative Values**
   If f(x) is positive for some values of x on [a, b] and negative for others, then the definite integral symbol $\int_a^b f(x)dx$ represents the cumulative sum of the signed areas between the graphs of y = f(x) and the x-axis where the areas above the x-axis are counted positively and the area below the x-axis are counted negatively.

3. **Fundamental Theorem of Calculus: If f is a continuous function on the closed interval [a, b] and F is any antiderivative of f, then**

$$\int_a^b f(x)dx = F(x)\Big|_a^b = F(b) - F(a); \qquad F'(x) = f(x)$$

CHAPTER 12

1. **Area between a Curve and the x Axis**

   For $f(x) \geq 0$ **over [a, b]:** $Area = \int_a^b f(x)dx$

   For $f(x) \leq 0$ **over [a, b]:** $Area = -\int_a^b f(x)dx$

2. **Area between two curves** $f(x) \geq g(x)$ *over the* int*erval* $[a,b]$

$$Area = \int_a^b [f(x) - g(x)]dx$$