Name_____**ID**_____

Part I. Multiple Choice   (4 points each)   No Calculators   No part credit.

1. $\frac{d}{dx}[\sin^{-1}(e^{x^2})] =$

   a. $\dfrac{2xe^{x^2}}{\sqrt{1-e^{2x^2}}}$

   b. $-\dfrac{e^{x^2}}{\sqrt{1-e^{2x^2}}}$

   c. $\dfrac{2xe^{x^2}}{1+\left(e^{x^2}\right)^2}$

   d. $\cos(e^{x^2})2xe^{x^2}$

   e. None of these

2. $\tan\left[\cos^{-1}\left(\frac{3}{5}\right)\right] =$

   a. $\frac{3}{5}$

   b. $\frac{3}{4}$

   c. $\frac{3}{\sqrt{8}}$

   d. $\frac{4}{5}$

   e. $\frac{4}{3}$

3. Find the critical numbers of $f(x) = \sqrt{1-x^2}$ over the interval $-1 \le x \le 1$.

   a. $0, \ -1, \ 1$

   b. $-1, \ 1$

   c. 1

   d. $-\sqrt{2}, \ \sqrt{2}$

   e. None

4. If you want to find the largest area of a rectangle whose base is on the x-axis and whose upper two vertices are on the parabola $y = 9 - x^2$ then you need to

   a. minimize $A = x(9 - x^2)$

   b. maximize $A = 2x\sqrt{9-x^2}$

   c. minimize $A = x\sqrt{9-x^2}$

   d. maximize $A = 2x(9 - x^2)$

   e. maximize $A = x(9 - x^2)$

1

5. What is the <u>largest</u> value of the function $f(x) = x^3 - 2x^2 - 3$ on the interval $[-2,3]$?

   a. -2

   b. -3

   c. $\frac{1}{4}\sqrt{2} - 4$

   d. 6

   e. 14

6. The position (in meters) of a particle falling through a fictitious medium is given by $s(t) = 4t^3 + 5t^2 + t + 1$. What is the acceleration of the particle when $t = 3$?

   a. 82 m/s^2

   b. 157 m/s^2

   c. 139 m/s^2

   d. 24 m/s^2

   e. 4 m/s^2

7. If $f'(x) = 4x^3 - 6x^2$ and $f(1) = 2$, what is $f(2)$?

   a. 8

   b. 3

   c. -8

   d. 20

   e. Cannot be determined from the information given.

8. Which of the following is an antiderivative of xe^x?

   a. $xe^x + C$

   b. $xe^x + e^x + C$

   c. $xe^x + x + C$

   d. $\frac{x^2 e^x}{2} + C$

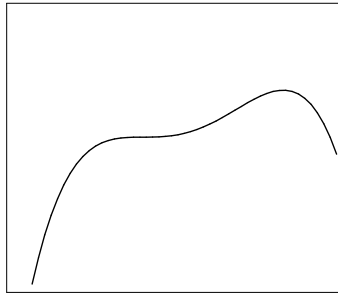   **e.** $xe^x - e^x + C$

9. For which of the following values of x does the function $f(x) = -x^3 + 2x^2 + 1$ have a local minimum?

    a. $\dfrac{2}{3}$
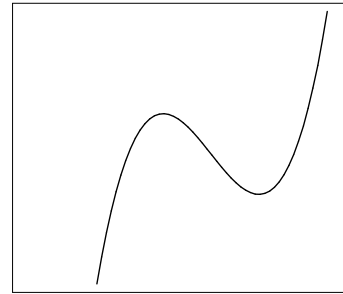
    b. $\dfrac{4}{3}$

    c. 0

    d. 1

    e. -2

10. Which of the following is the graph of $y = 2x^3 - 4x^2 + 1$?
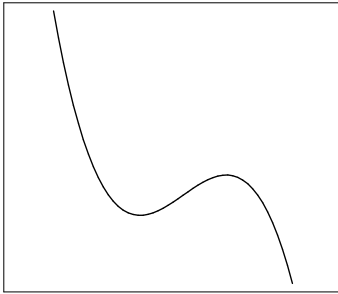
    a.   **b.**   **c.**
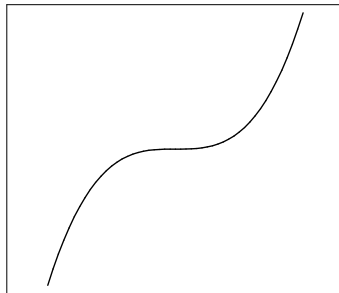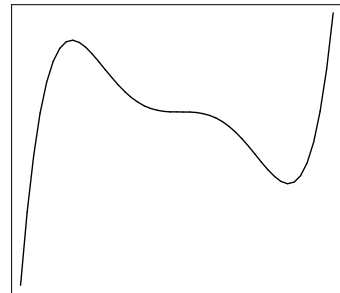
    d.   **e.**

11. Compute $\displaystyle\lim_{x\to 0} \dfrac{-\cos x + x^2 + 1}{x^2}$.

   **a.** 0

    b. $\dfrac{1}{2}$

    c. 1

    d. $\dfrac{3}{2}$

    e. Does not exist

Part II. Work out problems   (14 points each)   Partial credit will be given.
Calculators are permitted after the scantrons are collected.

12. A farmer wants to fence an area of 6 square miles in a rectangular field and then divide it in half with a fence parallel to one side of the rectangle. What are the dimensions of the field which minimize the total length of the fencing? Be sure draw a diagram and to state which dimension is the length of the extra dividing fence.

13. Four square corners are cut from a piece of cardboard 6 feet square, and the tabs are folded up to make an open box with a square base. What size corner should be cut to maximize the volume of the box? (See diagram.)
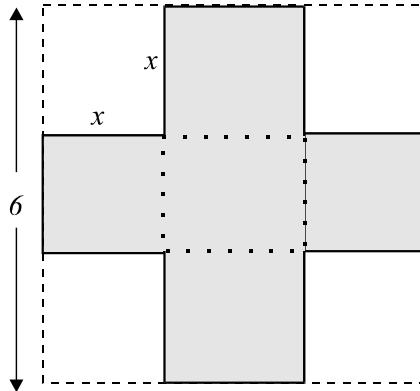
14. A bacteria culture starts with 5000 bacteria and the population doubles every 15 minutes.

    a. Find an expression for the population for any time t.

    b. Find the number of bacteria after 45 minutes.

    c. When will the population reach $100,000$?

15. Below is the graph of the derivative $f'(x)$ of a function $f(x)$, defined on the interval $-4 \le x \le 4$. Assume that the function is continuous on the interval. Use the graph to answer the following questions.
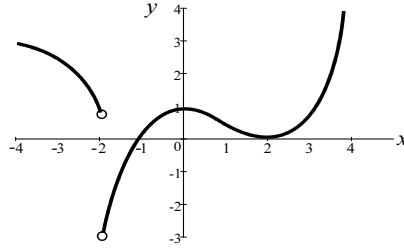
a. Identify the critical points of $f(x)$.

b. Find the intervals where the function is increasing.

c. Find the intervals where the function is concave up.

d. Find the x-values of the inflection points.