MA 16010 - Exam 3 Practice Exam 2

1. Let $f(x) = -x^3 + 12x$. The y values of the absolute minimum and the absolute maximum of $f(x)$ over the closed interval $[-3, 5]$ are respectively:

   A. -65 and -9
   B. -65 and 16
   C. -16 and -9
   D. -16 and 16
   E. -9 and 16

2. Choose the correct statement(s) about the function $f(x) = 2x^3 - 9x^2$.

   I. $f(x)$ has a relative maximum at $x = 0$.
   II. $f(x)$ has a relative minimum at $x = 3$.
   III. $f(x)$ is concave downward on $(-\infty, \frac{3}{2})$.

   A. I only
   B. II only
   C. I & III only
   D. II & III only
   E. All of the statements are true.

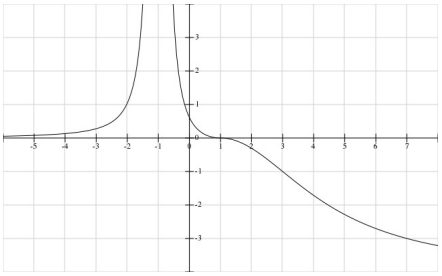
3. Find the point of inflection of $h(x) = xe^{-2x}$.

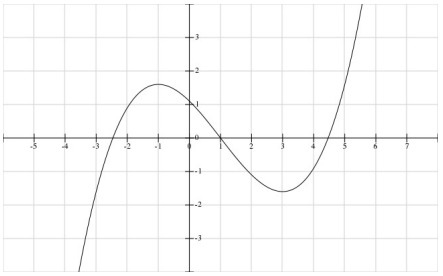
   A. $(-1, -e^2)$
   B. $\left(-\frac{1}{2}, -\frac{e}{2}\right)$
   C. $(0, 0)$
   D. $\left(\frac{1}{2}, \frac{1}{2e}\right)$
   E. $\left(1, \frac{1}{e^2}\right)$

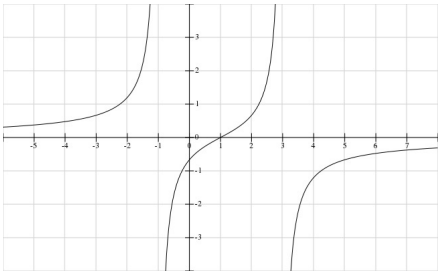
4. A function $f(x)$ satisfies the following conditions:

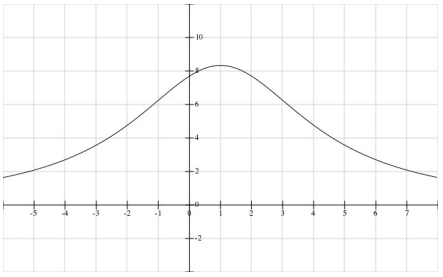
   (a) $f'(x) > 0$ on $(-\infty, -1)$
   (b) $f''(x) < 0$ on $(-1, 0)$
   (c) $f'(x) = 0$ at $x = 1$

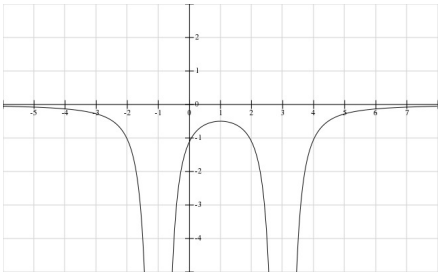
   Which of the following graphs is a possible graph of $f(x)$?

A. 

B. 

C. 

D. 

E. 

5. Which of the following functions satisfies $\lim_{x\to\infty} f(x) = -\infty$?

   A. $f(x) = \dfrac{x^4 - 16}{6x + 2}$

   B. $f(x) = \dfrac{6}{x} + 3$

   C. $f(x) = \dfrac{x^2 - 3x}{x - 5x^2}$

   D. $f(x) = \dfrac{2x - 5}{x^2 + 25}$

   E. $f(x) = \dfrac{x^3 - 27x}{7 - 4x^2}$

6. Which of the following describes all the asymptotes of the function $f(x) = \dfrac{-2x^2 - 5x + 7}{x + 3}$?

   A. $x = -3$, $y = -2$

   B. $x = -3$, $y = -2x + 1$

   C. $x = -2$, $y = 2x + 1$

   D. $x = -2$, $y = 0$

   E. $x = 3$, $y = 0$

7. A box with a square base and open top is to be made from 300 square inches of material. What is the volume of the largest box that can be made.

   A. 472 cubic inches
   B. 500 cubic inches
   C. 532 cubic inches
   D. 560 cubic inches
   E. 600 cubic inches

8. A poster is to have an area of 200 square inches with 1 inch margins on the left and right sides, and 2 inch margins on the top and bottom. Varying the dimensions of the poster changes the area of the region inside the margins. What is the maximum area inside the margins?

   A. 88 square inches
   B. 108 square inches
   C. 128 square inches
   D. 148 square inches
   E. 168 square inches

9. Find the x-coordinate of the point on the line of $y = 2x + 1$ that is closest to the point $(5, 1)$.

   A. 0

   B. 1

   C. 2

   D. 3

   E. 4

10. $\displaystyle\int \frac{3x^2 - 4}{2\sqrt{x}} dx =$

   A. $\displaystyle\frac{3}{4}\sqrt{x^3} - \frac{3}{\sqrt{x}} + C$

   B. $\displaystyle\frac{9}{4}\sqrt{x^5} + \sqrt{x} + C$

   C. $\displaystyle\frac{3}{5}\sqrt{x^5} - 4\sqrt{x} + C$

   D. $\displaystyle\frac{9}{4}\sqrt{x} + \frac{1}{\sqrt{x^3}} + C$

   E. $\displaystyle\frac{3}{7}\sqrt{x^7} - \frac{4}{3}\sqrt{x^3} + C$

11. Find the particular solution that satisfies the following differential equation and the initial conditions.

$$f''(x) = 3\cos(x), \quad f'(0) = 4, \quad f(0) = 7$$

A. $f(x) = -3\cos(x) + 4x + 7$

B. $f(x) = 3\cos(x) + 4x + 7$

C. $f(x) = -3\cos(x) + 4x + 10$

D. $f(x) = 3\cos(x) + 4x + 10$

E. $f(x) = 3\cos(x) + x + 7$

12. The growth rate of a bacteria in a Petri dish is given by

$$\frac{dP}{dt} = 2t + 7$$

where t is the time **in hours** and P is the population. If there are 1000 bacteria after **one day**, how many bacteria are there after **two days**?

A. $2,896$ bacteria

B. $3,311$ bacteria

C. $3,640$ bacteria

D. $4,624$ bacteria

E. $5,304$ bacteria