**MA 22300** **EXAM 3** **Form A**

NAME_____ INSTRUCTOR_____

INSTRUCTIONS

1. You must use a #2 pencil on the scantron answer sheet.
2. Fill in your name, your four digit section number, and your student identification number. Make sure to blacken in the appropriate spaces. If you do not know your section number, ask your instructor. (Leave the test/quiz number blank.) Sign your name.
3. There are 15 questions. Blacken in your choice of the correct answer in the spaces provided on the scantron answer sheet. **Only the scantron answer sheet will be graded. When you have completed the exam, turn in the scantron answer sheet only. You may take the exam booklet with you.**
4. **The exam is self-explanatory. Do not ask your instructor any questions about the exam problems.**
5. **Only one-line calculators (any brand) are allowed. Cell phones and PDA's may not be used as a calculator and must be put away during the exam. NO BOOKS OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper.**

**Volume & Surface Area**

**Right Circular Cylinder**
$V = \pi r^2 h$
$SA = \begin{cases} 2\pi r^2 + 2\pi rh \\ \pi r^2 + 2\pi rh \end{cases}$

**Sphere**
$V = \frac{4}{3}\pi r^3$
$SA = 4\pi r^2$

**Right Circular Cone**
$V = \frac{1}{3}\pi r^2 h$
$SA = \pi r\sqrt{r^2 + h^2} + \pi r^2$

**Interest Formulas**

$$B(t) = P(1 + \tfrac{r}{k})^{kt}$$

$$B(t) = Pe^{rt}$$

1. Find all the horizontal and vertical asymptotes for $f(x)$

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

A) Horizontal asymptote is $y = 3$, no vertical asymptotes

B) Horizontal asymptote is $y = 3$, vertical asymptotes are $x = 1$ and $x = -1$

C) No horizontal asymptotes, no vertical asymptotes

D) No horizontal asymptote, vertical asymptotes are $x = 1$ and $x = -1$

E) Horizontal asymptotes are $y = 1$ and $y = -1$, no vertical asymptotes.

2. A political advisory board indicates that t-months after a particular candidate announces their candidacy he/she will have S(t), percent of voter support. Where,

$$S(t) = \left(\frac{1}{8}\right)(580 + 24t + 6t^2 - t^3)$$

If the voter support model is valid for one year, how many months will it take from the time the candidate announces their candidacy until they have maximum voter support? Round your answer to the nearest tenth of a month.

A) 0 months

B) 1.2 months

C) 4.7 months

D) 5.5 months

E) 12 months

3. It is projected that $t$ years from now, the population of a certain country in millions will be

$$P(t) = P_0 e^{0.14t}$$

If the population is predicted to be 35 million people 3 years from now, what is the current population of the country? Round your answer to the nearest million.

A) 1 million people

B) 18 million people

C) 23 million people

D) 40 million people

E) 53 million people

4. If you solve the following equation for $x$, which statement is true?

$$\frac{3}{(2e)^{0.1x} - 5} = 2$$

A) $x < 10.4$

B) $10.4 < x < 10.7$

C) $10.7 < x < 11.0$

D) $11.0 < x < 11.3$

E) $x > 11.3$

5. If $f(x) = \left(\frac{x}{x+1}\right)^3$, $\quad f'(x) = -\frac{3x^2}{(x+1)^4}$, $\quad f''(x) = -\frac{6x(x-1)}{(x+1)^5}$, find all intervals where $f(x)$ is concave up.

A) $0 < x < 1$ and $1 < x < \infty$

B) $-1 < x < 0$ and $1 < x < \infty$

C) $-1 < x < 0$ and $0 < x < 1$

D) $x < -1$ and $1 < x < \infty$

E) $x < -1$ and $0 < x < 1$

6. Amy is an efficiency expert for a clothing factory. She conducts a study of the morning shift, from 8:00AM to 12:00PM (noon) at the factory and finds that the average worker who arrives on the job at 8:00AM will have produced $Q$ garments $t$ hours later, where $Q(t) = -2t^3 + 8t^2 + 2$. At what time during the morning shift is the average worker producing garments at the maximum rate?

   A) 10:40AM

   B) 8:00AM

   C) 12:00PM (noon)

   D) 9:00AM

   E) 9:20AM

7. Which function has only one vertical asymptote, which occurs at $x = 2$, and also has a horizontal asymptote at $y = \frac{1}{3}$?

   A) $\dfrac{6x^2 - 13x + 6}{6x^2 - 7x + 18}$.

   B) $\dfrac{x^2 + 3x + 2}{3x^2 - 9x + 6}$.

   C) $\dfrac{x^2 - 4x + 4}{3x^2 - 9x + 6}$.

   D) $\dfrac{x^2 - x - 2}{3x^2 - 12x + 12}$.

   E) $\dfrac{2x^2 + 3x - 2}{6x^2 - 13x + 2}$.

8. A box with square base and open top will be made using 1200 square mm of material. What is the largest possible volume of the box in cubic mm?

   A) 400 cubic mm

   B) 3000 cubic mm

   C) 4000 cubic mm

   D) 4207 cubic mm

   E) 8607 cubic mm

9. Solve for $x$.

$$36^{x^2-1} = \frac{1}{4^x 3^{2x}}$$

   A) $x = -\frac{1}{2} \pm \frac{\sqrt{5}}{2}$

   B) $x = \frac{1}{2} \pm \frac{\sqrt{5}}{2}$

   C) $x = -\frac{1}{2} \pm \frac{\sqrt{3}}{2}$

   D) $x = \frac{1}{2} \pm \frac{\sqrt{3}}{2}$

   E) $x = \pm 1$

10. Tricia has \$6,000 to invest. She wants it to have grown to \$10,000 after 7 years. What annual interest rate does she need if interest is compounded continuously? Round your answer to the nearest tenth of a percent.

A) 5.9%

B) 7.3%

C) 7.6%

D) 8.8%

E) 19.8%

11. Which one of the following functions has a graph with both a vertical asymptote and a point of inflection?

A) $y = (x^2 + 11x + 30)/(x + 5)$

B) $y = 1/x^3$

C) $y = x^3 + 3x^2 + 2x + 1$

D) $y = x + 1/x$

E) $y = 1/x^2 + 1/x$

12. Experiments find that the output $Q$ is a function of $x$ where $Q(x) = x^2 - x$, and $x$ is a function of $u$ where $x(u) = u^2 - \frac{1}{2}u$, $0 \leq u \leq 2$. Find the absolute minimum output for Q on the interval $0 \leq u \leq 2$.

A) $-\frac{1}{2}$

B) $-\frac{1}{4}$

C) $\frac{17}{256}$

D) 6

E) 0

13. The cost per square inch of constructing the top and bottom of a metallic cylindrical can, with radius $r$(in inches) and height $h$(in inches), is twice the cost per square inch of constructing its curved side surface. If its volume is $4\pi$ cubic inches, find the dimensions that will produce the least expensive can.

A) $r = 2, h = 1$

B) $r = \sqrt[3]{4}, h = \sqrt[3]{4}$

C) $r = 1, h = 4$

D) $r = \sqrt[3]{2}, h = \sqrt[3]{16}$

E) $r = \sqrt{2}, h = 2$

14. Find the $x$-values such that the function $f(x) = \frac{x^2-9}{x^2-1}$ has a point of inflection.

A) $x = 1$ and $x = -1$.

B) $x = 0$.

C) $x = 3$ and $x = -3$.

D) $x = 0$, $x = 3$, and $x = -3$.

E) There are no points of inflection.

15. A theater has a capacity of 8,200 people. With ticket prices at \$7, the average attendance was 3,300. When ticket prices were increased to \$10, the average attendance dropped to 2,400. If attendance is linearly related with ticket price, and the ticket price is adjusted to maximize revenue, then what is the maximum possible revenue?

A) \$ 2,790

B) \$ 8,100

C) \$ 27,900

D) \$ 24,300

E) \$ 54,300