

Form C

Midterm Exam II

22M:017

Thursday, April 17, 2003
7:00 P – 9:00 P

1. Find all vertical asymptotes of the graph of the function

$$y = \frac{x^2 + 2x - 1}{4x^2 + 5x + 1}$$

- a. $x = \frac{1}{4}$ b. $x = -\frac{1}{4}$ c. $x = 0$
d. $x = -1$ e. $x = -\frac{1}{4}$ and $x = -1$

2. Find all horizontal asymptotes of the graph of the function

$$y = \frac{x^2 + 2x - 1}{4x^2 + 5x + 1}$$

- a. $y = \frac{1}{4}$ b. $y = -\frac{1}{4}$ c. $y = 0$
d. $y = -1$ e. $y = -\frac{1}{4}$ and $y = -1$

Form C

3. Find all horizontal asymptotes of the graph of the function

$$y = \frac{x^2 + 2x + 1}{3x^3 + 7x + 2}$$

- a. $y = -2$ b. $y = -\frac{1}{3}$ c. $y = -2$ and $y = -\frac{1}{3}$
d. $y = \frac{1}{3}$ e. $y = 0$

4. On which interval is the function $y = x^2e^{2x}$ decreasing?

- a. $(0, 1)$ b. $(-1, 0)$ c. $(0, +\infty)$
d. $(1, +\infty)$ e. none

5. Find x at which the function $y = x^2e^{2x}$ has a relative maximum.

- a. $x = 1$ b. $x = 0$ c. $x = -1$
d. $x = -2$ e. none

6. Find an inflection point of the function $y = x^2e^{2x}$.

- a. $x = -1/2$ b. $x = -1$ c. $x = -1 + \sqrt{2}/2$
d. $x = -2 + \sqrt{2}$ e. none

Form C

7. On which interval is the function $f(x) = x^4 - 2x^2 + 1$ decreasing?

- a. $(-\infty, -1/\sqrt{3})$ b. $(-1/\sqrt{3}, 1/\sqrt{3})$ c. $(-1, 0)$
d. $(0, 1)$ e. $(1/\sqrt{3}, +\infty)$

8. Find x at which the function $f(x) = x^4 - 2x^2 + 1$ attains its absolute minimum on the interval $[-1/\sqrt{3}, 1/2]$.

- a. $x = -1$ b. $x = -1/\sqrt{3}$ c. $x = 0$
d. $x = 1/2$ e. $x = 1$

9. On which interval is the function $f(x) = x^4 - 2x^2 + 1$ concave downward?

- a. $(-\infty, -1/\sqrt{3})$ b. $(-1/\sqrt{3}, 1/\sqrt{3})$ c. $(-1, 0)$
d. $(0, 1)$ e. $(1/\sqrt{3}, +\infty)$

Form C

10. Let $C(x) = x^3 - 2x + 400$ be the cost of producing x units of a particular commodity, and $p(x) = 30 - 2x$ the unit price at which all x units can be sold. Find the level of production x where marginal revenue equals marginal cost.

- a. $x = 8/3$
- b. $x = -4$
- c. $x = 0$
- d. $x = -\sqrt[3]{370}$
- e. $x = -4$ and $x = 8/3$

11. Let $C(x) = x^3 - 2x + 400$ be the cost of producing x units of a particular commodity, and $p(x) = 30 - 2x$ the unit price at which all x units can be sold. That is, $C(x)$ and $p(x)$ are the same as in Question 10. Find the level of production x where marginal cost equals average cost.

- a. $x = 10$
- b. $x = 20$
- c. $x = \sqrt[3]{800}$
- d. $x = \sqrt[3]{200}$
- e. none

12. A carpenter has been asked to build a box with a square base. The sides of the box will cost \$3 per square foot, the top will cost \$2 per square foot, and the base will cost \$4 per square foot. Denote by x the side length of the base and by h the height. What are the dimensions of the box of greatest volume that can be constructed for \$36?

- a. $x = 2$ ft and $h = 9$ ft
- b. $x = \sqrt{2}$ ft and $h = \sqrt{2}$ ft
- c. $x = \sqrt{2}$ ft and $h = 1/\sqrt{2}$ ft
- d. $x = \sqrt{2}$ ft and $h = 4/\sqrt{2}$ ft
- e. $x = \sqrt{2}$ ft and $h = 8/\sqrt{2}$ ft

Form C

13. Compute the indefinite integral

$$\int \left(3x^2 + \frac{1}{x}\right) \left(\frac{1}{x} - 2\right) dx$$

a. $\left(6x - \frac{1}{x^2}\right) \left(\frac{1}{x} - 2\right) + \left(3x^2 + \frac{1}{x}\right) \left(-\frac{1}{x^2}\right)$

b. $3 - 12x - \frac{2}{x^3} + \frac{2}{x^2} + C$

c. $3 - 12x - \frac{1}{x} - 2 \ln |x| + C$

d. $\frac{3}{2}x^2 - 2x^3 - \frac{2}{x^3} + \frac{2}{x^2} + C$

e. $\frac{3}{2}x^2 - 2x^3 - \frac{1}{x} - 2 \ln |x| + C$

14. Compute the indefinite integral

$$\int \frac{2x^3 + x}{\sqrt{x}} dx$$

a. $\frac{(6x^2 + 1)\sqrt{x} - (2x^3 + x)/(2\sqrt{x})}{x}$

b. $5x^{3/2} + 1 + C$

c. $\frac{4}{7}x^{7/2} + \frac{2}{3}x^{3/2} + C$

d. $5x^{3/2} + \frac{1}{2}x^{-1/2} + C$

e. $\frac{4}{7}x^{7/2} + \frac{1}{2}x^2 + C$

Form C

15. A manufacturer has found that marginal cost is $5q + 10$ dollars per unit when q units have been produced. The total cost of producing the first two units is \$150. What is the total cost of producing the first 10 units?

- a. \$470 b. \$350 c. \$120 d. \$110
e. \$710

16. Integrate the indefinite integral by substitution:

$$\int xe^{-x^2} dx$$

- a. $2e^{-x^2} + C$ b. $\frac{1}{2}e^{-x^2} + C$
c. $-2e^{-x^2} + C$ d. $-\frac{1}{2}e^{-x^2} + C$
e. $e^{-x^2} + C$

17. Integrate the indefinite integral by substitution:

$$\int \frac{1}{2x+5} dx$$

- a. $2 \ln(2x+5) + C$ b. $\frac{1}{2} \ln(2x+5) + C$
c. $2 \ln|2x+5| + C$ d. $\frac{1}{2} \ln|2x+5| + C$
e. $\ln|2x+5| + C$