Math 110 All Sections

Winter 2010

Exam 2

February 4-10, 2010

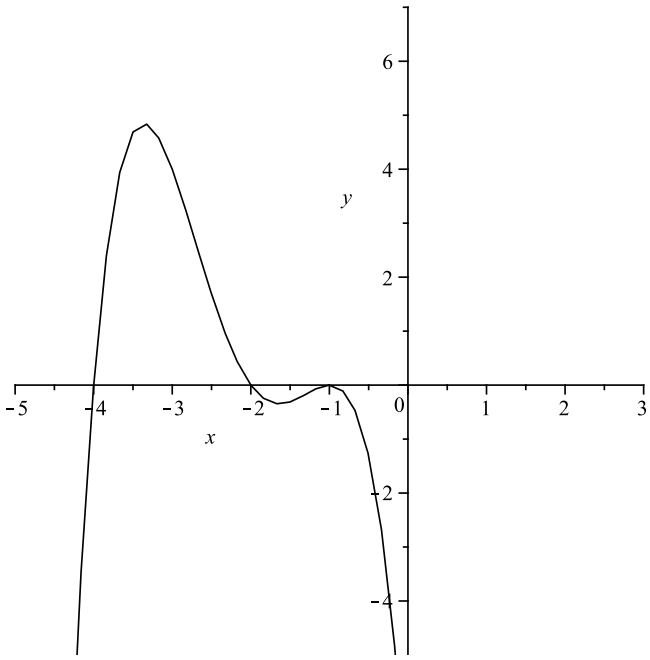
All questions are multiple choice. There is no time limit. No notes are allowed.
Please do not write on the exam.

Math 110 Exam 2

Do Not Write on this Test. Put all work on your scratch paper.

1. For the polynomial, $f(x) = 9(x-2)^3(x+11)^2$, list each real zero. Determine whether the graph of f crosses or touches the x-axis at each x-intercept.
   (a) 2, touches the x-axis; 11, crosses the x-axis
   (b) 2, crosses the x-axis; 11, touches the x-axis
   (c) 2, touches the x-axis; -11, crosses the x-axis
   (d) 2, crosses the x-axis; -11, touches the x-axis
   (e) -2, touches the x-axis; 11, crosses the x-axis
   (f) -2, crosses the x-axis; 11, touches the x-axis

2. Which of the following polynomial functions might have the graph shown below?



   (a) $-(x-2)\cdot(x-4)\cdot(x-1)^2$
   (b) $-(x-2)^2\cdot(x-4)^2\cdot(x-1)$
   (c) $-(x+2)\cdot(x+4)\cdot(x+1)^2$
   (d) $-(x+2)^2\cdot(x+4)^2\cdot(x+1)$
   (e) $-(x-2)\cdot(x-4)\cdot(x-1)$
   (f) $-(x+2)\cdot(x+4)\cdot(x+1)$

3. Form a polynomial whose zeros and degree are given:

Zeros: -3,-1, 0, 1; Degree: 4

(a) $x^3 + 3x^2 - x + 3$ (b) $x^3 - 5x^2 + 7x - 3$ (c) $x^3 - x$

(d) $x^4 - 3x^3 - x^2 + 3x$ (e) $x^4 - 6x^3 + 3x + 1$ (f) $x^4 + 3x^3 - x^2 - 3x$

4. Find the vertical asymptotes, if any, of the rational function,

$$\frac{7x}{x^3 + 10x^2 - 24x}$$

(a) $x = 0$, $x = 2$, $x = -12$
(b) $x = 0$, $x = -2$, $x = 12$
(c) $x = -2$, $x = 12$
(d) $x = 0$, $x = 2$
(e) $x = 2$, $x = -12$
(f) none

5. Find the domain of the rational function,

$$\frac{x(x-3)}{x^2 - 9}$$

(a) $\{x|x \neq 0, x \neq 3\}$ (b) $\{x|x \neq -3, x \neq 3\}$ (c) $\{x|x \neq 0, x \neq -3\}$

(d) $\{x|x \neq 3\}$ (e) $\{x|x \neq -3\}$ (f) The function is defined for all x.

6. If $x^5 + x^4 + x^3 + x^2 + x + 1$ is divided by $x - 1$, what is the remainder?

(a) 1 (b) 2 (c) 3

(d) 4 (e) 5 (f) 6

7. Give the equation(s) of the horizontal asymptote(s), if any, of the rational function,

$$\frac{-12x^2 + 5x - 13}{4x^2 + 6x + 8}$$

(a) $y = -3$ (b) $y = 4$ (c) $y = 12$

(d) $y = -\frac{1}{2}$ (e) $y = 6$ (f) none

8. Give the equation(s) of the oblique asymptote(s), if any, of the rational function,

$$\frac{3x^4+4}{x^3+3x}$$

(a) $y = x - 1$ (b) $y = x$ (c) $y = 2x - 1$

(d) $y = 3x$ (e) $y = 4x - 2$ (f) none

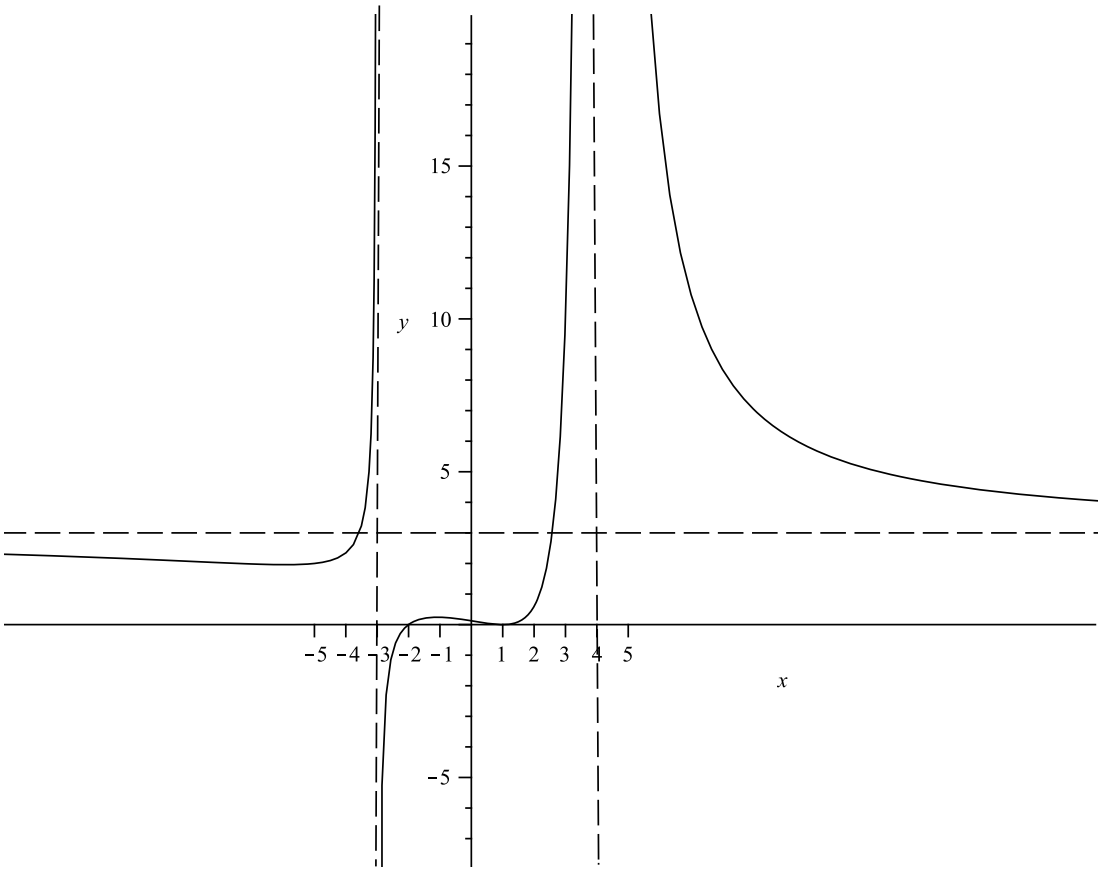
9. Find k such that $x + 1$ is a linear factor of the polynomial,

$$4x^4 + 3kx^3 - 9kx^2 - 4kx + 12.$$

(a) 0 (b) 1 (c) 2

(d) -2 (e) $\frac{1}{2}$ (f) $-\frac{1}{2}$

10. Decide which of the rational functions might have the given graph.



(a) $\dfrac{3(x+2)^2(x-1)}{(x+3)^2(x-4)}$ (b) $\dfrac{3(x-2)(x+1)^2}{(x-3)(x+4)^2}$ (c) $\dfrac{3(x+2)(x-1)^2}{(x+3)(x-4)^2}$

(d) $\dfrac{-3(x+2)^2(x-1)}{(x+3)^2(x-4)^2}$ (e) $\dfrac{-3(x-2)(x+1)^2}{(x-3)(x+4)^2}$ (f) $\dfrac{-3(x+2)(x-1)^2}{(x+3)(x-4)}$

For questions 11-13, solve the given inequality. Express the solution using interval notation.

11. $x^4 < 4x^2$

(a) $(-\infty, -2) \cup (2, \infty)$ (b) $(-\infty, -2] \cup [2, \infty)$ (c) $(-2, 2)$

(d) $[-2, 2]$ (e) $(-2, 0) \cup (0, 2)$ (f) $[-2, 0) \cup (0, 2]$

12. $x(x-7) > 8$

(a) $(-\infty, 0) \cup (7, \infty)$ (b) $(0, 7)$ (c) $[0, 7]$

(d) $(-\infty, -1) \cup (8, \infty)$ (e) $(-1, 8)$ (f) $[-1, 8]$

13. $\frac{(x+5)^2}{x^2-4} \geq 0$

(a) $(-\infty, -2) \cup (2, \infty)$ (b) $(-\infty, -2] \cup [2, \infty)$ (c) $(-2, 2)$

(d) $[-2, 2]$ (e) $(-\infty, 5)$ (f) $(-\infty, 5]$

14. Let $f(x)$ be a polynomial of degree 5 with real coefficients. If it is given that $3 + i$ and $5i$ are zeros of $f(x)$, what can be concluded about the number of real zeros of the polynomial?

(a) $f(x)$ has no real zeros.
(b) $f(x)$ has at least one real zeros.
(c) $f(x)$ has exactly one real zero.
(d) $f(x)$ has at least two real zeros.
(e) $f(x)$ has exactly two real zeros.
(f) It can only be concluded that $f(x)$ has no more than 3 real zeros.

15. Find the sum of all the real zeros of the polynomial function, $f(x) = 4x^4 + 7x^2 - 2$.

(a) 0 (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$

(d) $\frac{3}{4}$ (e) $-\frac{3}{4}$ (f) $\frac{3}{2}$

16. The polynomial $f(x) = x^3 + 4x^2 - 72x - 35$ factors to $f(x) = (x - 7)(ax^2 + bx + c)$. Find $(a + b + c)$.

(a) 16 (b) 17 (c) 18

(d) 19 (e) 20 (f) 21

17. Suppose $f(x)$ is a polynomial such that $f(-10) = 5$, $f(-3) = -1$, $f(0) = -6$, and $f(11) = 32$. Using the Intermediate Value Theorem, what can be concluded about the number of zeros of $f(x)$?

(a) $f(x)$ has no real zeros.
(b) $f(x)$ has at least one real zeros.
(c) $f(x)$ has exactly one real zeros.
(d) $f(x)$ has at least two real zeros.
(e) $f(x)$ has exactly two real zeros.
(f) Nothing can be concluded about the number of real zeros of $f(x)$.

18. The coefficients of a polynomial $f(x)$ are real numbers. Given the following degree and zeros of $f(x)$, find the remaining zero(s).

Degree: 5; Zeros: $3, -5i, \frac{-1+\sqrt{3}i}{2}$

(a) $-3, 5i, \frac{-1-\sqrt{3}i}{2}$ (b) $-3, 5i, \frac{1-\sqrt{3}i}{2}$ (c) $-3, 5i$

(d) $-3, \frac{1-\sqrt{3}i}{2}$ (e) $5i, \frac{-1-\sqrt{3}i}{2}$ (f) $5i, \frac{1-\sqrt{3}i}{2}$

19. Which of the following quadratic polynomials has no real roots?

(a) $x^2 - 1$ (b) $2x^2 + 20x + 42$ (c) $x^2 + 5x - 6$

(d) $4x^2 - 17x$ (e) $x^2 + x + 1$ (f) $x^2 - 6x + 8$

20. Find **all** zeros of the polynomial,

$$x^4 - x^2 - 2x + 2.$$

(a) $1; -1; 1 + i; 1 - i$ (b) $1; -1; -1 - i; -1 - i$

(c) $-1; 1 + i; 1 - i$ (d) $1; -1 + i; -1 - i$

(e) $1; -1; -1 + 2i; -1 - 2i$ (f) $1; -1; 1 - 2i; -1 - 2i$

Solutions

1. d
2. c
3. f
4. e
5. b
6. f
7. a
8. d
9. c
10. c
11. e
12. d
13. a
14. c
15. a
16. b
17. d
18. e
19. e
20. d