Math 110 All Sections
Fall 2011
Exam 2

September 29 - October 5

All questions are multiple choice. There is no time limit. No notes are allowed.

Please do not write on the exam.
1. For the polynomial \( f(x) = -3(x^2 + 1)(x - 9)^3 \) find the zeros and determine if the graph crosses or touches the x-axis at the given zero

(a) touches at -1 and 9
(b) touches at 1, crosses at 9
(c) crosses at -1 and 1, crosses at 9
(d) crosses at 9
(e) touches at -1
(f) none of the above

2. Find the y-value of the y-intercept of the function \( f(x) = \frac{(x+5)(x+2)(x-3)}{x-1} \)

(a) -5
(b) -2
(c) 3
(d) 1
(e) 30
(f) none of the above

3. Which of the following functions could have the following graph?

(a) \( f(x) = 3x(x - 1)(x - 2) \)
(b) \( f(x) = 3x(x - 1)^2(x - 2) \)
(c) \( f(x) = -x(x - 1)(x - 2) \)
(d) \( f(x) = x(x + 1)(x + 2) \)
(e) \( f(x) = -x(x + 1)(x + 2) \)
(f) none of the above
4. Find the vertical asymptotes of the function \( f(x) = \frac{2(x-1)}{x^2+9x-10} \)

(a) \( x = 1 \) and \( x = -10 \)
(b) \( x = -1 \) and \( x = -10 \)
(c) \( x = -10 \)
(d) \( x = 1 \)
(e) \( x = -1 \)
(f) none of the above

5. Find the domain of the function \( f(x) = \sqrt{4x+8} \)

(a) \( (-\infty, \infty) \)
(b) \( (-\infty, 3) \)
(c) \( (0, \infty) \)
(d) \( (-\infty, 0) \cup (0, \infty) \)
(e) \( [-2, \infty) \)
(f) none of the above

6. Find any horizontal asymptotes of the function \( f(x) = \frac{5x^3+2x^2-x+7}{9x^4+1} \)

(a) \( y = 0 \)
(b) \( y = 1 \)
(c) \( y = \frac{5}{9} \)
(d) \( y = 7 \)
(e) none of the above

7. Find the oblique asymptote, if any, of the function \( f(x) = \frac{2x^2+3x+1}{x+3} \).

(a) \( y = x \)
(b) \( y = 2x \)
(c) \( y = 2x - 3 \)
(d) \( y = 3x + 2 \)
(e) \( y = x + 3 \)
(f) there are no oblique asymptotes.

8. What sort of symmetry does the graph of the function \( f(x) = \frac{5x^2+3}{-3x^4+9x^2+5} \) have?

(a) even symmetry (across the y-axis)
(b) odd symmetry (around the origin)
(c) even and odd symmetry
(d) neither even nor odd symmetry
9. The function $f(x) = \frac{x^4 + x^2}{x^2 - 29}$ could have which of the following graphs?

For 10-13 solve the inequality. Express the answer in interval notation.

10. $(x - 3)(x + 10) \geq 0$
   (a) $[-10, 3]$
   (b) $[-10, \infty)$
   (c) $(-\infty, -10) \cup [3, \infty)$
   (d) $(-\infty, -10] \cup [3, \infty)$
   (e) $(-10, 3)$
   (f) none of the above

11. $\frac{x^2 - 1}{x - 1} \geq 0$
    (a) $(-1, 1)$
    (b) $[-1, 1) \cup (1, \infty)$
    (c) $(-\infty, -1) \cup [1, \infty)$
    (d) $(\infty, -1) \cup (-1, 1) \cup (1, \infty)$
    (e) $(-\infty, -1]$ 
    (f) none of the above

12. $x^4 \leq 4x^2$
    (a) $(-\infty, 2]$
    (b) $(-\infty, 2]$
    (c) $(-\infty, 0) \cup (0, 2)$
    (d) $[0, 2]$
    (e) $[-2, 2]$
    (f) none of the above
13. \( \frac{x+15}{x-15} \leq 1 \)

(a) \((-\infty, \infty)\)
(b) \((-\infty, 0]\)
(c) \((-\infty, 15)\)
(d) \([15, \infty)\)
(e) \((15, \infty)\)
(f) none of the above

14. The polynomial \( f(x) \) has real coefficients and is of degree five. Additionally \( f(x) \) has the zeros \( 3 - i \) and \( 8 + 9i \). How many real zeros does \( f(x) \) have?

(a) 0 real zeros
(b) 1 real zero
(c) 2 real zeros
(d) 3 real zeros
(e) 4 real zeros
(f) 5 real zeros
(g) we cannot tell how many real zeros \( f(x) \) has

15. How many real zeros does the polynomial \( f(x) = x^4 + 7x^2 + 10 \) have?

(a) 0 real zeros
(b) 1 real zero
(c) 2 real zeros
(d) 3 real zeros
(e) 4 real zeros
(f) none of the above

16. The function \( f(x) = x^3 + x^2 + x + 1 \) has one real zero. What is it?

(a) -2
(b) -1
(c) 0
(d) 1
(e) 2
(f) none of the above
17. The function \( f(x) = 2x^3 + 11x^2 + 10x + 25 \) can be written as \( f(x) = (x + 5)(ax^2 + bx + c) \). What is \((a + b + c)\)?

(a) 0
(b) 2
(c) 4
(d) 6
(e) 8
(f) none of the above.

18. Which of the following is a factor of \( f(x) = x^3 + 9x^2 + 23x + 15 \)?

(a) \((x + 5)\)
(b) \((x + 2)\)
(c) \((x + 7)\)
(d) \((x - 4)\)
(e) \((x - 2)\)
(f) none of the above

19. Find a polynomial of degree three with zeros 2 and \( i \).

(a) \( x^3 - 2x^2 + x - 2 \)
(b) \( 2x^3 - 2x^2 - 2 \)
(c) \( x^3 + x - 2 \)
(d) \( 4x^3 - 2x^2 - 2 \)
(e) \( x^3 + 5x^2 - x + 2 \)
(f) none of the above

20. The function \( f(x) = x^5 + 8x^3 + x^2 + 16x + 4 \) can be written \( f(x) = (x - 2i)(x + 2i)q(x) \) where \( q(x) \) is a degree three polynomial. Find \( q(x) \).

(a) \( x^3 + 4x^2 + 1 \)
(b) \( x^3 + 4x + 1 \)
(c) \( 2x^3 + 1 \)
(d) \( x^3 + x^2 + x + 1 \)
(e) \( x^3 + 3x^2 + 2x + 1 \)
(f) none of the above
Answers

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