

Instructor: David Wright - course coordinator

# Math 110 (College Algebra)

## Midterm Exam 2 Fall 2014

October 2, 2014 through October 8, 2014

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Instructions:

- DO NOT WRITE on the exam.
- Mark the best answer on the bubble sheet provided.
- There is no time limit.
- Books, calculators, and notes are not allowed.
- Please do not talk about the test with other students until after the last day to take the exam.

1. Which of the following polynomials has degree 7?

- a) 7    b)  $5x^2(x^2 - 3)^5$     c)  $x^7 - x^9$   
d)  $x(x - 3)(x + 2)^2(x - 1)^3$     e)  $x^3 + x^4$     f)  $7(x - 1)^2 + 13$

2. Determine the interval on which the function  $f(x) = x^2 + 3x + 2$  is increasing.

- a)  $(-2, -1)$     b)  $(-\infty, 0)$     c)  $(-3, \infty)$   
d)  $(-\frac{3}{2}, \infty)$     e)  $(-\infty, -\frac{1}{4})$     f)  $(-2, -\frac{1}{4})$

3. Determine where  $f(x) = x^4 + x^3 - 12x^2 < 0$ .

- a)  $(-4, 0) \cup (3, \infty)$     b)  $(-4, 0) \cup (0, 3)$   
c)  $(-\infty, -4) \cup (0, 3)$     d)  $(-\infty, -4) \cup (3, \infty)$   
e) All real numbers.    f)  $f(x)$  is nowhere positive.

4. What is the domain of  $R(x) = \frac{x^3}{x^4 + x^2}$ ?

- a)  $\{x|x \neq 0\}$     b)  $\{x|x \neq 0, x \neq -1\}$   
c)  $\{x|x \neq 0, x \neq -1, x \neq 1\}$     d)  $\{x|x \neq -1, x \neq 1\}$   
e)  $\{x|x \neq -1\}$     f) All real numbers.

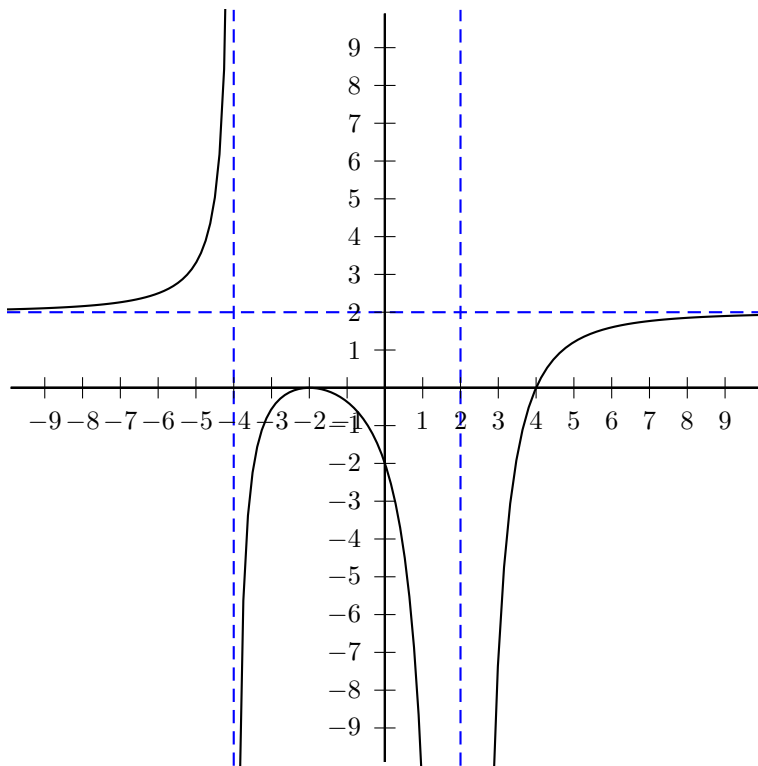
5. Find all the vertical asymptotes of  $f(x) = \frac{x^2 - 4x + 3}{x^2 - 1}$ .

- a)  $x = 3, 1$     b)  $x = 1$     c)  $x = -1$   
d)  $x = \sqrt{2}$     e)  $x = -3, -1$     f)  $x = -1, 1$

6. What is the equation of the oblique asymptote of  $R(x) = \frac{5x^4 - 2x^3 + 1}{x^3 - x^2 + 1}$ ?

- a)  $y = 5x$     b)  $y = 5x + 1$     c)  $y = 5x - 1$   
d)  $y = 5x + 2$     e)  $y = 5x - 2$     f)  $y = 5x + 3$

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7. Consider the graph. Which of the following is a candidate function for this graph?

a)  $\frac{-2(x+2)^2(x-4)}{(x+4)(x-2)^2}$

b)  $\frac{2(x+2)^2(x-4)}{(x+4)(x-2)^2}$

c)  $\frac{2(x-2)^2(x+4)}{(x-4)(x+2)^2}$

d)  $\frac{(x-2)^2(x+4)}{(x-4)(x+2)}$

e)  $\frac{(x+2)^2(x-4)}{(x-4)(x+2)}$

f)  $\frac{(x+2)^2(x-4)}{2(x+4)^2(x-2)}$

8. Where is  $\frac{x+1}{x^2-4}$  positive?

a)  $(-\infty, -2) \cup (-1, 2)$

b)  $(-\infty, -2) \cup (2, \infty)$

c)  $(-2, -1) \cup (2, \infty)$

d)  $(-1, 2) \cup (2, \infty)$

e)  $(-2, -1) \cup (-1, 2)$

f) All real numbers.

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9. Which of the following is an asymptote of  $\frac{2x^2 - 5x + 2}{x^2 - 9}$ ?

- |                 |             |
|-----------------|-------------|
| a) $x = 2$      | b) $x = -2$ |
| c) $y = 2$      | d) $y = -2$ |
| e) $y = 2x - 5$ | f) $x = 9$  |

10. Solve the inequality  $x^2 \leq x + 20$ .

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| a) $(-5, 4)$                        | b) $(-4, 5)$                        |
| c) $[-5, 4]$                        | d) $[-4, 5]$                        |
| e) $(-\infty, -5) \cup (4, \infty)$ | f) $(-\infty, -4) \cup (5, \infty)$ |

11. Solve the inequality  $\frac{(x-1)(3-x)}{(x+3)^2} \leq 0$ .

- |  |  |
|--|--|
| a) $(-3, 1) \cup (1, 3)$                         | b) $[-3, 1) \cup (1, 3]$                         |
| c) $(-\infty, -3) \cup [3, \infty)$              | d) $(-\infty, -3) \cup (-3, 1) \cup (3, \infty)$ |
| e) $(-\infty, -3) \cup (-3, 1] \cup [3, \infty)$ | f) $(-\infty, -3) \cup (-3, \infty)$             |

12. Solve the inequality  $\frac{x^2 - 4}{x} \leq 3$ .

- |                                |                                |
|--------------------------------|--------------------------------|
| a) $[-1, 4]$                   | b) $(-1, 4)$                   |
| c) $[-1, 0) \cup (0, 4]$       | d) $(-\infty, -1] \cup (0, 4]$ |
| e) $(-\infty, -1) \cup [0, 4)$ | f) $[-1, 0) \cup [4, \infty)$  |

13. What is the remainder when  $x^{101} - 9x^{99} + x^2 - 7$  is divided by  $x - 3$ ?

- |      |       |       |
|------|-------|-------|
| a) 0 | b) 1  | c) -1 |
| d) 2 | e) -2 | f) 3  |

14. Use the rational zeros theorem (or rational roots test) to determine which of the following is not a potential zero of  $3x^{35} - 15x^{17} + 7x^{14} + 2x - 15$ .

- |                  |                   |                   |
|------------------|-------------------|-------------------|
| a) 15            | b) -5             | c) 1              |
| d) $\frac{5}{3}$ | e) $-\frac{1}{3}$ | f) $-\frac{1}{5}$ |

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15. Does  $x^9 - x^8 - x^7 + 13x^2 - 1$  have any real zeros?
- Yes.
  - No.
  - Impossible to tell.
16. By using the Intermediate Value Theorem (IVT), does  $x^5 + 3x^4 - x^3 + x + 2$  have a zero between  $-1$  and  $1$ ?
- Yes.
  - No.
  - IVT is inconclusive.
17. Suppose we know that a polynomial  $f(x)$  with real coefficients has zeros  $1$ ,  $2i$ ,  $3i$ , and  $1 - i$ . Then what do we know about the degree of  $f(x)$ ?
- The degree of  $f(x)$  is at most 7.
  - The degree of  $f(x)$  is exactly 7.
  - The degree of  $f(x)$  is at least 7.
  - None of the above.
18. Find the sum of the complex zeros of  $x^3 - 27$ .
- |      |                  |                   |
|------|------------------|-------------------|
| a) 0 | b) $\frac{3}{2}$ | c) $-\frac{3}{2}$ |
| d) 3 | e) $-3$          | f) $\frac{5}{2}$  |
19. Let  $f(x) = x^3 + x^2 - x + 15$ . Given that  $1 - 2i$  is a zero of  $f(x)$ , find the remaining complex zeros.
- |                        |                         |                        |
|------------------------|-------------------------|------------------------|
| a) $x = \{1 + 2i\}$    | b) $x = \{1 + 2i, -3\}$ | c) $x = \{1 + 2i, 3\}$ |
| d) $x = \{1 + 2i, 1\}$ | e) $x = \{1 + 2i, -1\}$ | f) $x = \{1 + 2i, 5\}$ |
20. Form a polynomial of degree four whose coefficients are real numbers and has the zeros  $1$ ,  $2$ ,  $-4 - i$ .
- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| a) $x^4 + 5x^3 - 5x^2 - 35x + 34$   | b) $2x^4 + 5x^3 - 10x^2 - 25x + 68$  |
| c) $x^4 + 7x^3 - 14x^2 + 17x - 34$  | d) $3x^4 + 15x^3 - 2x^2 + 33x + 122$ |
| e) $x^4 - 13x^3 + 26x^2 - 42x - 71$ | f) $-x^4 + x^3 - 5x^2 - 4x + 1$      |

END OF EXAM

**KEY:**

1. D
2. D
3. B
4. A
5. C
6. F
7. B
8. C
9. C
10. D
11. E
12. D
13. D
14. F
15. A
16. C
17. C
18. A
19. B
20. A