Math 110 (College Algebra)
Midterm Exam 2

February 5-11, 2015

Instructions:

- DO NOT WRITE on the exam.
- Choose the one choice that best completes the statement or answers the question.
- Fill in the answer to each problem on your computer-scored answer sheet.
- There is no time limit.
- No books, notes, or calculators allowed.

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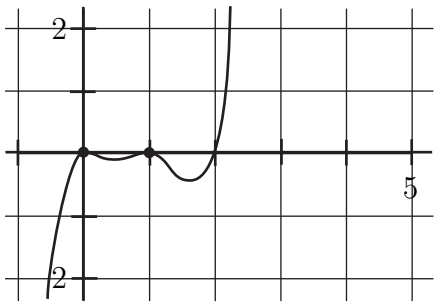
1. Form a polynomial of degree 3 whose zeros are 1, i, and $-i$.

   (a) $x^3 + x$ (b) $x^3 - x$ (c) $x^3 + x^2 + x + 1$ (d) $x^3 - x^2 + x - 1$
   (e) $x^3 - x^2 - x - 1$ (f) $x^3 - x + 1$

2. Select the function that represents the given graph.



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

3. Let $R(x) = \dfrac{x^3}{x^2 - 4}$. Find all vertical asymptotes, if any.

   (a) No vertical asymptotes (b) $x = 0$ (c) $x = 2$ (d) $x = -2$
   (e) $x = 0$, $x = 2$ (f) $x = 2$, $x = -2$

4. Find the domain of the following rational function: $f(x) = \dfrac{3x^2 - 20x - 7}{7x(x-3)}$.

(a) $\left\{x \,|\, x \neq 7,\, x \neq -\dfrac{1}{3}\right\}$ (b) $\left\{x \,|\, x \neq -7,\, x \neq \dfrac{1}{3}\right\}$ (c) $\{x \,|\, x \neq 3,\, x \neq 0\}$

(d) $\{x \,|\, x \neq -3,\, x \neq 0\}$ (e) $\{x \,|\, x \neq 0,\, x \neq -7\}$ (f) All real numbers

5. Let $R(x) = \dfrac{x^3 + x^2 - x + 1}{x^2 - 1}$. Find the oblique asymptote if there is one.

(a) No oblique asymptote (b) $y = 0$ (c) $y = 1$

(d) $y = x$ (e) $y = x + 1$ (f) $y = x - 1$

6. Let $R(x) = \dfrac{3x^3}{2x^3 - 1}$. Find the horizontal asymptote if there is one.

(a) No horizontal asymptote (b) $y = \dfrac{2}{3}$ (c) $y = 0$

(d) $y = 3$ (e) $y = \dfrac{3}{2}$ (f) $y = 2$

7. Solve the inequality: $\dfrac{(x+4)(3-x)}{(x-2)^2} \geq 0$.

(a) $[-4, 2] \cup [2, 3]$ (b) $[-4, 2) \cup (2, 3]$ (c) $(-\infty, -4) \cup (2, 3]$

(d) $(-\infty, 4) \cup (-4, 2) \cup (3, \infty)$ (e) $[-4, 2] \cup (2, \infty)$ (f) $(-\infty, 2) \cup (2, 3]$

8. Solve the following inequality: $(x+4)(x-6)(x-12) \geq 0$.

(a) $(-\infty, 4) \cup (6, 12)$ (b) $(-\infty, 4] \cup [6, 12]$ (c) $(-4, 6) \cup (12, \infty)$

(d) $[-4, 6] \cup [12, \infty)$ (e) $(-4, 6] \cup [12, \infty)$ (f) $[-4, 6] \cup (12, \infty)$

9. Solve the inequality: $\dfrac{4x+6}{x+3} \leq 3$.

(a) $(-3, 3]$ (b) $[-3, 3)$ (c) $(-\infty, -3) \cup [3, \infty)$

(d) $(-\infty, -3] \cup (3, \infty)$ (e) $[-3, 3]$ (f) $(-\infty, -3]$

10. Solve the inequality: $x^4 + 2x > x$.

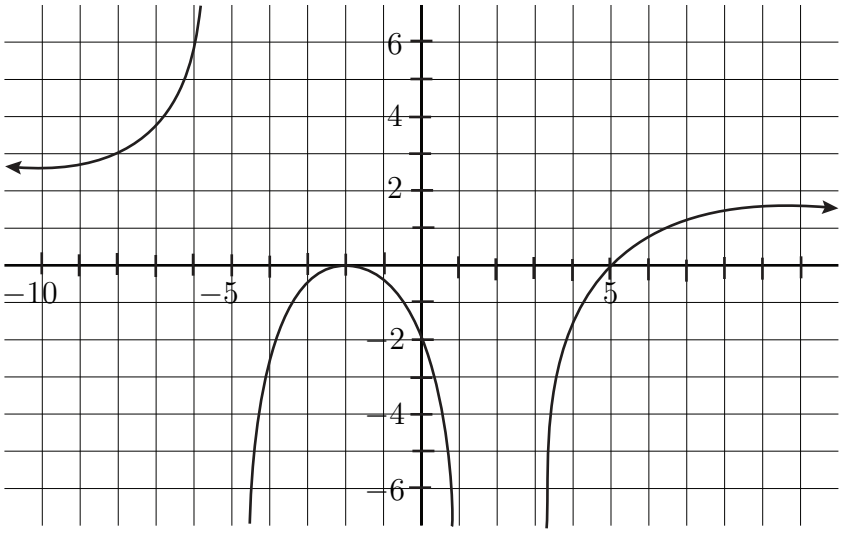
(a) $(-\infty, 1) \cup (1, \infty)$ (b) $(-\infty, -1) \cup (0, \infty)$ (c) $(-\infty, 0) \cup (1, \infty)$

(d) $(-\infty, 0) \cup (0, \infty)$ (e) $(-1, 1)$ (f) $(-\infty, 1)$

11. If $x^{100} + x^3 + 1$ is divided by $x + 1$, then the remainder is

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

12. Find a rational function that has the following graph:



(a) $\dfrac{-2(x+2)^2(x-5)}{(x+5)(x-2)^2}$ (b) $\dfrac{(x+2)^2(x-5)}{(x+5)(x-2)^2}$ (c) $\dfrac{2(x+2)^2(x-5)}{(x+5)(x-2)^2}$

(d) $\dfrac{2(x+2)(x-5)^2}{(x+5)(x-2)^2}$ (e) $\dfrac{2(x+2)(x-5)^2}{(x+5)^2(x-2)}$ (f) $\dfrac{2(x+2)^2(x-5)^2}{(x+5)(x-2)}$

13. List the potential rational zeros of the polynomial function. Do not find the zeros.

$$f(x) = 6x^4 + 4x^3 - 3x^2 + 2$$

(a) $\pm\dfrac{1}{2}, \pm\dfrac{3}{2}, \pm 1, \pm 2, \pm 3, \pm 6$

(b) $\pm\dfrac{1}{6}, \pm\dfrac{1}{3}, \pm\dfrac{1}{2}, \pm 1, \pm 2$

(c) $\pm\dfrac{1}{6}, \pm\dfrac{1}{3}, \pm\dfrac{1}{2}, \pm\dfrac{2}{3}, \pm 1, \pm 2, \pm 3$

(d) $\pm\dfrac{1}{6}, \pm\dfrac{1}{3} \pm\dfrac{1}{2}, \pm\dfrac{2}{3}, \pm 1 \pm 2$

(e) $\pm\dfrac{1}{6}, \pm\dfrac{1}{4}, \pm\dfrac{1}{3}, \pm\dfrac{1}{2}, \pm\dfrac{2}{3}, \pm\dfrac{3}{4}, \pm 1, \pm 2, \pm 3$

(f) $\pm\dfrac{1}{6}, \pm\dfrac{1}{4}, \pm\dfrac{1}{3}, \pm\dfrac{1}{2}, \pm 1, \pm 2, \pm 3, \pm 4, \pm 6$

14. The polynomial $x^4 + 6x^3 + 9x^2 - 4x - 12$ has four rational zeros. Find the zero that has multiplicity of two.

(a) 3 (b) 1 (c) 2 (d) -1 (e) -2 (f) -3

15. Find k so that $f(x) = x^3 - kx^2 + kx + 3$ has the factor $x - 3$.

(a) $k = 2$ (b) $k = 3$ (c) $k = 4$ (d) $k = 5$ (e) $k = 6$ (f) $k = 7$

16. Let $f(x)$ be a polynomial so that $f(1) = -1$, $f(2) = 3$, $f(3) = -5$, and $f(4) = 1$. Then the Intermediate Value Theorem promises that there must be how many zeros for $f(x)$, for x between 1 and 4?

(a) none (b) one (c) two (d) three (e) four (f) five

17. Form a polynomial with real coefficients of degree two so that $2 - 3i$ is zero.

(a) $x^2 + 4x + 13$ (b) $x^2 - 4x + 13$ (c) $x^2 + 4x - 13$ (d) $x^2 - 4x - 13$
(e) $x^2 + 2x - 13$ (f) $x^2 + 2x + 13$

18. The coefficients of the polynomial $f(x)$ are real numbers. Find the remaining zeros of f. Degree 5; zeros: 2, i, $-2i$

(a) $-i$, $2i$ (b) $2 + i$, $2 - 2i$ (c) $-2, -i, 2i$ (d) $-2, -i$ (e) $-2, 2i$
(f) $-2i, 2i$

19. Find all solutions to $x^3 + 3x^2 + 4x + 2 = 0$.

(a) 1, $1 + i$, $1 - i$ (b) 1, $-1 + i$, $-1 - i$ (c) 1, i, -1 (d) -1, $1+i$, $1-i$
(e) -1, $-1+i$, $-1-i$ (f) -1, i, $-i$

20. Let $f(x) = x^5 - x^3 - 12x$. Find the zeros of $f(x)$ and choose the appropriate response.

(a) There is exactly one real zero of $f(x)$
(b) There are exactly two real zeros of $f(x)$
(c) There are exactly three real zeros of $f(x)$
(d) There are exactly four real zeros of $f(x)$
(e) There are exactly five real zeros of $f(x)$
(f) There are no real zeros

Answers

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