Math 110 (College Algebra)
RED-DO NOT WRITE ON THIS EXAM

Midterm Exam 2 Fall 2015

October 1, 2014 through October 7, 2014

Instructions:

- Mark the correct answer on the bubble sheet provided.
- Calculators are not allowed.
- Please do not talk about the test with other students until after the last day to take the exam.

In questions 1-4 use the polynomial function

$$f(x) = -2(x+1)^2(x-4)^3(x+2).$$

1. What is the degree of f?

   a) 3 b) -2 c) 16
   d) 6 e) 2 f) 1

2. What is the y-intercept of f?

   a) $y = 16$ b) $y = -2$ c) $y = -1$
   d) $y = 4$ e) $y = 256$ f) None of these.

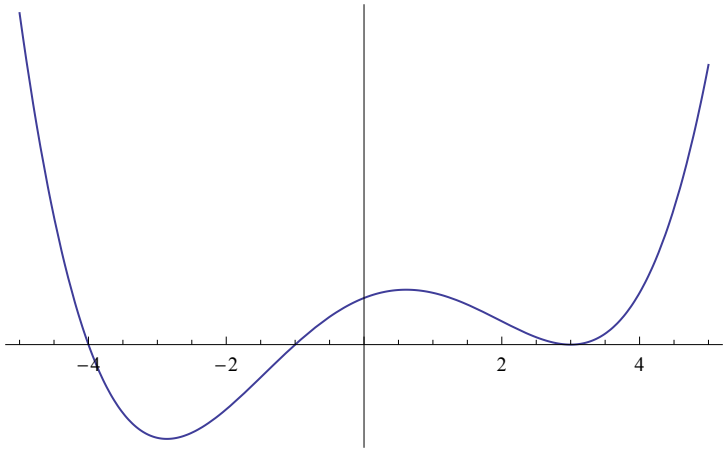
3. What is the end behavior of f?

   a) Up to the right and up to the left.
   b) Up to the right and down to the left.
   c) Down to the right and up to the left.
   d) Down to the right and down to the left.
   e) There is a horizontal asymptote at $y = -2$.
   f) None of the above.

4. On what set is value of $f(x) > 0$?

   a) $(-\infty, -2] \cup [-1, 4]$ b) $(-\infty, -2) \cup (-2, -1] \cup (4, \infty)$
   c) $(-\infty, -2) \cup (4, \infty)$ d) $(-\infty, -2] \cup \{1\} \cup [4, \infty)$
   e) $(-2, -1) \cup (-1, 4)$ f) $[-2, 4]$

5. Which polynomial could have the following graph?



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

In questions 6-9 use the rational function

$$R(x) = -\frac{(x-5)(2x+1)}{(x-2)^2(x+3)}.$$

6. What are the x-intercepts of R?

a) $x = 2, -3, \frac{1}{2}, 5$
b) $x = 2, -3$
c) $x = -\frac{1}{2}, 5$
d) $x = -2, 3, -\frac{1}{2}, -5$
e) $x = -2, 3$
f) $x = \frac{1}{2}, -5$

7. What are the vertical asymptotes of R?

a) $x = 2, -3, \frac{1}{2}, 5$
b) $x = 2, -3$
c) $x = -\frac{1}{2}, 5$
d) $x = -2, 3, -\frac{1}{2}, -5$
e) $x = -2, 3$
f) $x = \frac{1}{2}, -5$

8. What is the end behavior of R?

a) R has a horizontal asymptote at $y = 2$
b) R has a horizontal asymptote at $y = -2$
c) R has a horizontal asymptote at $y = 0$
d) R has a oblique (slant) asymptote at $y = \frac{1}{2}x + \frac{7}{4}$.
e) R goes down to the right and down to the left.
f) R goes up to the right and up to the left.

9. Recall,

$$R(x) = -\frac{(x-5)(2x+1)}{(x-2)^2(x+3)}.$$

On what set is $R(x) \leq 0$?

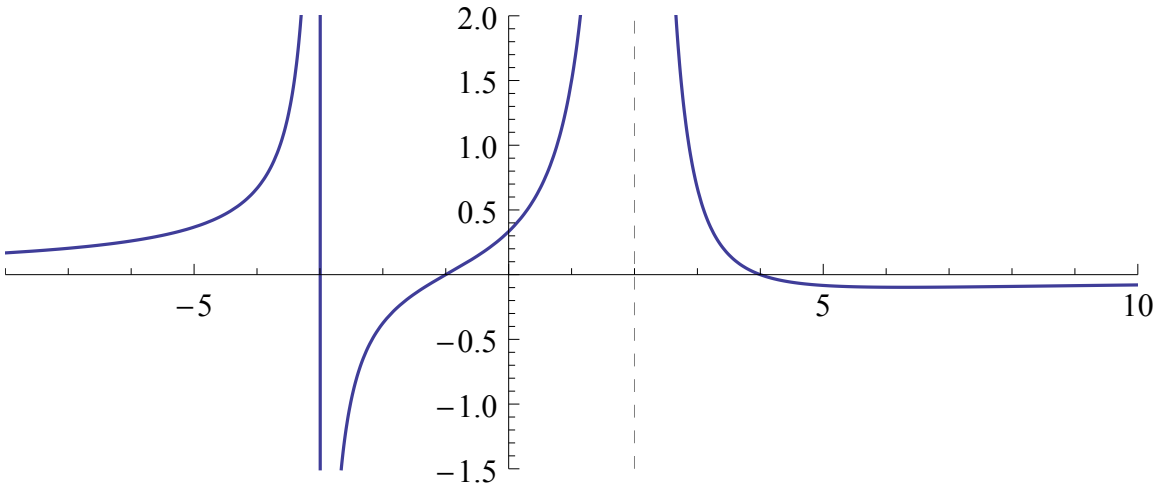
a) $(-\infty, -3] \cup [0, 2)$
b) $(-\infty, -3) \cup (-\frac{1}{2}, 5)$
c) $(-2, -\frac{1}{2}) \cup \{2\} \cup (5, \infty)$
d) $(-3, -\frac{1}{2}] \cup [5, \infty)$
e) $(-\infty, -5) \cup (\frac{1}{2}, 3)$
f) $(-\infty, -3) \cup (-\frac{1}{2}, 2) \cup (2, 5)$

10. What is the domain of the following rational function?

$$R(x) = \frac{x^2 - 7x + 12}{2x^2 - 6x - 8}$$

a) $\{x | x \neq -8, 12\}$
b) $\{x | x \neq -1, 3\}$
c) $\{x | x \neq 4, 3, -1\}$
d) $\{x | x \neq -1\}$
e) $\{x | x \neq -1, 4\}$
f) $\{x | x \neq 3, 4\}$

11. Which rational function could have the following graph?

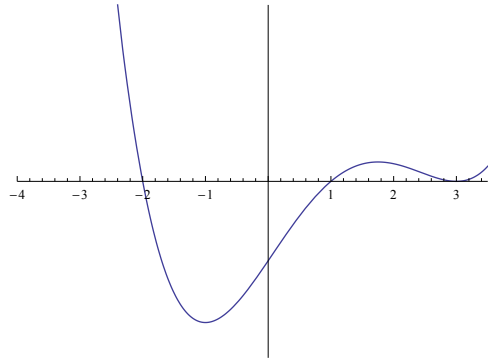


a) $R(x) = -\frac{(x-4)(x+1)}{(x-2)^2(x+3)}$
b) $R(x) = -\frac{(x+4)(x-1)}{(x+2)^2(x-3)}$
c) $R(x) = -\frac{(x+4)(x-1)}{(x+2)(x-3)}$
d) $R(x) = -\frac{(x-4)(x+1)}{(x-2)(x+3)}$
e) $R(x) = \frac{(x+4)(x-1)}{(x+2)(x-3)}$
f) $R(x) = \frac{(x+4)(x-1)}{(x+2)^2(x-3)}$

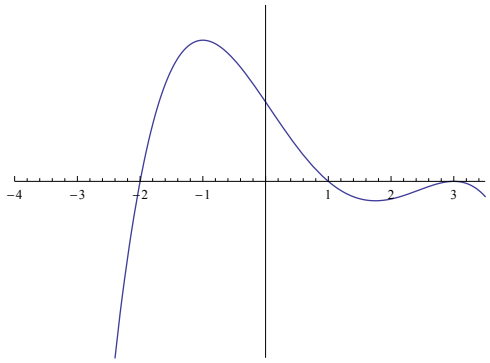
12. Which of the following is the graph of the function

$$f(x) = x^4 + 3x^3 - 7x^2 - 15x + 18?$$

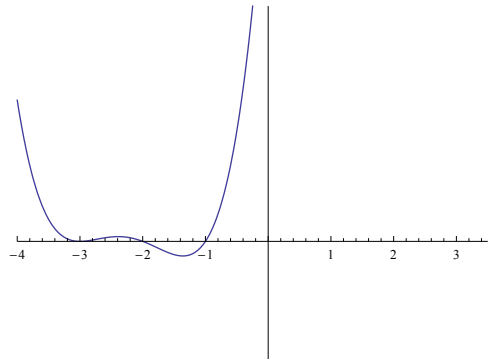
a)



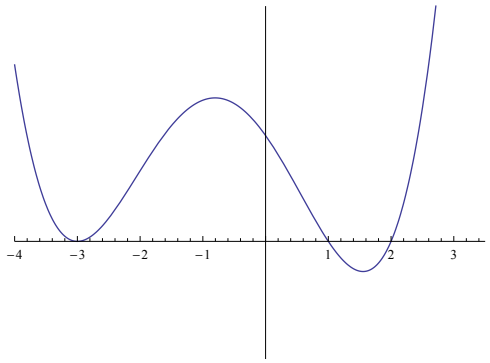
b)



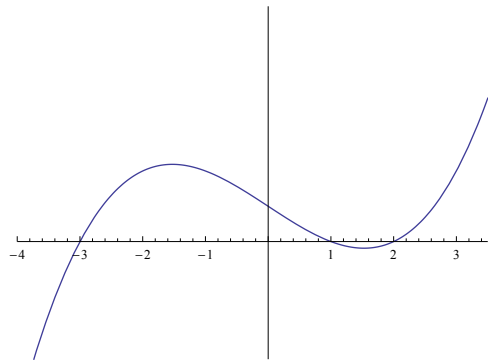
c)



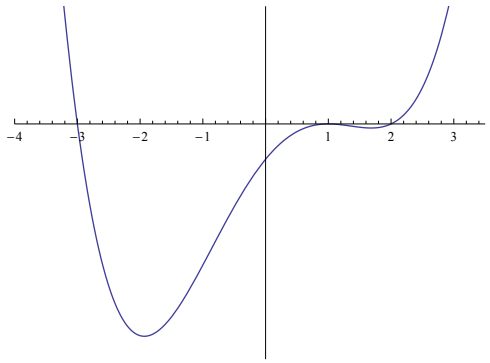
d)



e)



f)



13. What are all the roots of the polynomial $2x^3 - 4x^2 + 18x - 36$?

a) $1, 3, -3$

b) $2, 3i, -3i$

c) $-2, 3i, -3i$

d) $1, \frac{3}{2}i, -\frac{3}{2}i$

e) $2, 3, -3$

f) 2

14. What is the set of all x for which

$$2x^2 - 13x + 10 \geq -x^3$$

is true?

a) $(-\infty, -4) \cup (1, 3)$
b) $[-4, 1] \cup [3, \infty)$
c) $(-4, 1) \cup (3, \infty)$
d) $(-\infty, -5) \cup (1, 2)$
e) $[-5, 1] \cup [2, \infty)$
f) $(-\infty, -5] \cup [1, 2]$

15. Let $f(x) = x^5 + x^4 + 4x^3 - 4x^2 + 3x - 5$. If we know that i is a root, what all the roots of f?

a) $-1, i, -i, -1 + 2i, -1 - 2i$
b) $1, i, -i, -1 + 2i, -1 - 2i$
c) $-5, -1, i, 1 + 2i, 1 - 2i$
d) $5, i, -i, 1 + i, 1 - i$
e) $-1, i, -i, 1 + i, 1 - i$
f) $-1, i, -i, -1 + i, -1 - i$

16. What is the set of all x for which

$$\frac{1}{x-2} \leq \frac{1}{x^2 + x - 6}$$

is true?

a) $(-\infty, -2)$
b) $(-\infty, -3)$
c) $(-3, -2] \cup (2, \infty)$
d) $(-3, \infty)$
e) $(-\infty, -3] \cup [-2, 2)$
f) $(-\infty, -2) \cup [2, 3)$

17. If $f(x) = x^{100} - 2x^{99} - 4x + 8$ Which of the following are factors of f?

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

18. Using the Remainder Theorem, what would be the remainder of $x^6 - 3x^4 + 2x^3 + x^2 + x + 6$ divided by $x + 1$?

a) 8
b) 2
c) -2
d) 6
e) -3
f) 7

19. According the the Rational Roots Theorem (sometimes called the Rational Roots Test) what are all the possible rational roots of the following polynomial?

$$3x^6 + 67x^4 + 1007x^3 + x^2 - 456x + 15$$

a) $\pm 15, \pm 10, \pm 5, \pm 3, \pm 1, \pm\frac{10}{3}, \pm\frac{5}{3}, \pm\frac{1}{3}$

b) $\pm 15, \pm 5, \pm 3, \pm 1, \pm\frac{5}{3}, \pm\frac{1}{3}$

c) $\pm 45, \pm 30, \pm 15, \pm 5, \pm 3, \pm 1$

d) $\pm 3, \pm 1, \pm\frac{1}{3}, \pm\frac{1}{5}, \pm\frac{1}{15}$

e) $\pm 5, \pm 3, \pm 1, \pm\frac{10}{3}, \pm\frac{5}{3}, \pm\frac{1}{3}$

f) None of the above.

20. Consider the polynomial $f(x) = 3(x-2)(3x-1)^2(x+4)^5(x+1)^3$ which of the following statements is true about f?

a) It has degree 4, the graph of f crosses the x-axis at $x = -4$ but not at $x = -1$.

b) It has degree 11, the graph of f crosses the x-axis at $x = -2$ but not at $x = \frac{1}{3}$.

c) It has degree 5, the graph of f crosses the x-axis at $x = 2$ and at $x = -1$.

d) It has degree 11, the graph of f touches but does not cross the x-axis at $x = \frac{1}{3}$ and at $x = -1$, but crosses at $x = -4$.

e) It has degree 11, the graph of f crosses the x-axis at $x = 2$, at $x = -1$, and at $x = -4$.

f) It has degree 5, the graph of f crosses the x-axis at $x = 2$, at $x = -1$, and at $x = \frac{1}{3}$.

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