DO NOT WRITE ON THIS EXAM

MATH 110 - College Algebra

EXAM 2   October 4-10, 2018

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Instructions:
• Calculators and notes are not allowed.
• Do not write on this exam.
• Mark the correct answer on the bubble sheet provided.
• There is only one correct answer for each multiple choice question.
• There is no time limit.
• Please do not talk about the test with other students until after October 10.

(1) Which of the following is NOT a polynomial?
(a) $\sqrt{2}x^2 + \pi x - 7$
(b) $3$
(c) $x^3 - 8x$
(d) $x^{-1} + 2x^{\frac{1}{2}} - 3x^{\frac{3}{2}}$
(e) $x^4 + 1$
(f) $x^2 + 2x + 1$

(2) What is the degree of the following polynomial: $P(x) = 5(x - 2)^2(x + 4)^7(x + 1)$?
(a) 9
(b) 10
(c) 11
(d) 12
(e) 13
(f) 14
(3) Which statement is FALSE about the polynomial \( P(x) = -3(x + 1)^2(x - 4) \):

(a) Its smallest zero has multiplicity 2.
(b) It has a maximum of 2 turning points.
(c) It has degree 3.
(d) It has a zero at \( x = 1 \).
(e) It touches, but does not cross the x-axis at \( x = -1 \).
(f) It crosses the x-axis at \( x = 4 \).

(4) What is the domain of \( R(x) = \frac{x^2 + 8x + 16}{2x^2 - 2x - 4} \)?

(a) \(( -\infty, -4) \cup (-4, -1) \cup (-1, 2) \cup (2, \infty)\)
(b) \(( -\infty, -1) \cup (-1, \infty)\)
(c) \(( -\infty, -1) \cup (-1, 2) \cup (2, \infty)\)
(d) \((1, 2)\)
(e) \(( -4, 2)\)
(f) \(( -\infty, -4) \cup (-4, 2) \cup (2, \infty)\)

(5) List all of the asymptotes of \( R(x) = \frac{-5x}{x - 2} \):

(a) Vertical: \( x = 2 \); Horizontal: \( y = -5 \)
(b) Vertical: \( x = -5 \); Horizontal: \( y = 2 \)
(c) Vertical: \( x = 0 \); Horizontal: \( y = 2 \)
(d) Vertical: \( x = -5 \); Oblique: \( y = 2x \)
(e) Vertical: \( x = 2 \); Oblique: \( y = -5x \)
(f) Vertical: \( x = 2 \); Oblique: \( y = x \)
(6) Given the following graph, find a rational function that has the given graph.

(a) \( R(x) = \frac{(x+3)(x-1)^2}{(x+1)(x-2)} \)

(b) \( R(x) = \frac{(x-3)(x+1)}{(x-1)(x+2)} \)

(c) \( R(x) = \frac{(x-3)^2(x+1)}{(x-1)^2(x+2)} \)

(d) \( R(x) = \frac{(x+3)(x-1)}{(x+1)(x-2)} \)

(e) \( R(x) = \frac{(x-3)(x+1)^2}{(x-1)(x+2)} \)

(f) \( R(x) = \frac{(x+3)^2(x-1)}{(x+1)^2(x-2)} \)
(7) What are the domain and range of the function in Problem (6)?
(a) Domain and Range are all real numbers
(b) Domain = All real numbers, Range = $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$
(c) Domain = $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$, Range = $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$
(d) Domain = $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$, Range = $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$
(e) Domain = $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$, Range = $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$
(f) Domain = $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$, Range = All real numbers

(8) What are the x and y intercepts of $f(x) = 6x^3 + 18x^2 + 12x$
(a) x-intercepts: $-2, -1, 0$; y-intercept: 0
(b) x-intercepts: 0, 1, 2; y-intercept: 0
(c) x-intercepts: $-2, -1, 0$; y-intercept: None
(d) x-intercepts: 0, 1, 2; y-intercept: None
(e) x-intercepts: 6, 12; y-intercept: 18
(f) x-intercepts: 6, 18; y-intercept: 12

(9) Find the oblique asymptote for $R(x) = \frac{x^3 - 5}{x^2 + 4x + 5}$
(a) $y = x + 4$
(b) $y = x + 5$
(c) $y = x - 5$
(d) $y = x - 4$
(e) $y = x$
(f) $y = -x$

(10) Solve the inequality $x^3 > x$.
(a) $(-\infty, -1) \cup (0, 1)$
(b) $(-1, 0) \cup (1, \infty)$
(c) $(0, \infty)$
(d) $(-\infty, -1) \cup (1, 2)$
(e) $(-2, -1) \cup (1, \infty)$
(f) $(-\infty, 0)$
(11) Solve the inequality \( \frac{x^2 - 1}{x^2 + 10x + 24} \leq 0 \).
(a) \((-\infty, -6) \cup [1, \infty)\)
(b) \([-1, 1] \cup [4, 6]\)
(c) \((-6, -4) \cup [-1, 1]\)
(d) \((-\infty, -6) \cup [4, 6]\)
(e) \((-1, 1) \cup (4, \infty)\)
(f) \((-\infty, -6) \cup (-4, -1) \cup (1, \infty)\)

(12) Solve the inequality \( \frac{x^2 + 2}{x} > 3 \).
(a) \((1, 2)\)
(b) \((-\infty, 0) \cup (1, 2)\)
(c) \((0, 1) \cup (2, \infty)\)
(d) \((0, 1)\)
(e) \((2, \infty)\)
(f) \((-\infty, 0)\)

(13) Use the Remainder Theorem to find the remainder of \( f(x) = x^3 - 4x + 7 \) divided by \( x + 2 \).
(a) 7
(b) 8
(c) 9
(d) 10
(e) 11
(f) 12

(14) List all the possible rational zeroes of the polynomial \( P(x) = 2x^5 - 12x^3 + x^2 - 5 \).
(a) \(\pm 1\)
(b) \(\pm 1, \pm 5\)
(c) \(\pm 1, \pm 5, \pm \frac{1}{2}\)
(d) \(\pm 1, \pm 5, \pm \frac{5}{2}\)
(e) \(\pm \frac{5}{2}\)
(f) \(\pm 1, \pm 5, \pm \frac{1}{2}, \pm \frac{5}{2}\)
(15) Find all the real zeros of \( f(x) = x^3 - 4x^2 - 11x - 6 \)

(a) \(-11, -4\)  
(b) \(-4\)  
(c) \(-11\)  
(d) \(-1\)  
(e) \(-1, 6\)  
(f) \(6\)

(16) On which interval does the Intermediate Value Theorem guarantee a zero for the polynomial \( P(x) = x^3 - 6x^2 + 12x - 8 \)?

(a) \([-5, -3]\)  
(b) \([5, 7]\)  
(c) \([3, 5]\)  
(d) \([-3, -1]\)  
(e) \([-1, 1]\)  
(f) \([1, 3]\)

(17) Find the complex zeroes of \( x^2 + 4x + 5 \).

(a) \(-1 \pm 3i\)  
(b) \(-3 \pm i\)  
(c) \(-1 \pm 2i\)  
(d) \(-2 \pm i\)  
(e) \(-1 \pm i\)  
(f) \(-2 \pm 2i\)
(18) If we are given a degree 3 polynomial with real coefficients and the following zeroes: 2, 5 − i; what are the remaining zeroes?

   (a) −2          (c) −5          (e) −2, 5 + i
   (b) 5 + i       (d) 2 + i       (f) −5, −2 + i

(19) Find a polynomial with degree 3 that has the following zeroes: 2 + i, −3.

   (a) x^3 + 7x^2 − x + 5          (d) x^3 − x^2 + x − 1
   (b) x^3 − 4x + 5                 (e) x^3 + 3
   (c) x^3 − x^2 − 7x + 15           (f) x^3 − 9x^2 + 3x − 2

(20) Consider the zeroes of x^3 − 64 that are complex numbers but are not real numbers. Find the sum of these numbers.

   (a) −4          (c) 2          (e) i
   (b) 4           (d) −2         (f) −i
**Answer Key**

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