Here are a number of sample questions. On the test you will also be expected to use a graphing calculator to find the real zeros and the min / max of a polynomial in one variable.

5-1:
Simplify each expression.

1. \( x^8 \cdot x^{-9} \)
2. \( (2x^2)^4 \)
3. \( (4x^4)^2 \)
4. \( \frac{8x^8 y^6}{6x^8 y^2} \)
5. \( \frac{14x^{-3} y^2 z^{-6}}{-28xy^3 z^9} \)
6. \( (5x^5 y^3)(6x^6 y) \)
7. \( \left(-7x^{-4} y^{-3}\right)(4x^2 y^9) \)
8. \( 4xy(2x^2 y^3)(3x^3 y^5) \)
9. \( \left(\frac{6x^6 y^6}{9x^9 y^4}\right)^4 \)
10. \( \left(\frac{10x^6 y^4}{6x^2 y^2}\right)^{-3} \)
11. \( \left(\frac{x^4 y^4}{x^2 y^8}\right)^2 \)
12. \( \left(\frac{x^4 y^4}{x^2 y^8}\right)^{-2} \)
13. \( (2c^2 - 4c + 6) + (5c^2 + 2c - 10) \)
14. \( (5d^2 + 3d + 6) - (7d^2 - 10) \)
15. \( (3x - 7)(7x + 2) \)
16. \( (5x - 1)^2 \)
17. \( (2x - 1)(x^2 + 5x - 6) \)
18. \( (2x^2 - 3)(3x - 7) \)

Find the perimeter and area of each figure.

19. \( 3x^2 + 4 \)
20. \( x - 2 \)

5-2:
Divide.

1. \( (16a^4 b^7 - 4a^3 b^3 - 12a^2 b^4) \)
2. \( \frac{5a^2 b - 15ab^3 + 10a^3 b^4}{5ab} \)
3. \( (16y^5 + 20x^2 y^7 - 12x^4)(4x^2 y^3)^{-1} \)

Divide using long division.

4. \( (x^3 - 2x - 15) ÷ (x - 5) \)
5. \( (a^2 - 5a + 3)(a - 2)^{-1} \)
6. \( \frac{4x^3 + 2x^2 - x + 11}{x - 6} \)
7. \( \frac{6x^4 - 8x^3 + 12x - 14}{x - 2} \)
8. \( \frac{6x^3 - 17x^2 + 6x + 8}{3x - 4} \)
9. \( (15x^3 + 8x^2 - 21x + 6)(5x - 4)^{-1} \)

5-3:
Determine whether the following expressions are polynomials in one variable. If they ARE polynomials in one variable, state the degree and leading coefficient. If they are NOT polynomials in one variable, state why.

1. \( 7x^5 + 5x^6 - 3x^7 - 11x^8 + 19x^2 \)
2. \( 15x^2 - 4xy + 30y^2 \)
3. \( \sqrt{x - 7} \)
4. \( x - \sqrt{7} \)
5. \( 14x^2 + 5x - 9x^{-1} \)
6. \( 18x^3 + 5x - \frac{9}{x} + 99 \)
Evaluate each function for the given values.

7. If \( g(x) = 6x^2 - 9x + 14 \), find \( g(-2) \).
8. If \( g(x) = 6x^2 - 9x + 14 \), find \( g(3m^3) \).
9. If \( q(x) = 9x^2 - 2x + 14 \), find \( q(3a + 1) \).
10. If \( q(x) = 9x^2 - 2x + 14 \), find \( q(x - 4) \).

For each graph, (a) determine if the graph represents an EVEN or an ODD function, (b) determine if the leading coefficient is POSITIVE or NEGATIVE, (c) state the number of turning points, (d) state the number of distinct real zeros, and (e) describe the end behavior.

11. [Graph]
12. [Graph]

For each function, (a) determine if it is an EVEN or an ODD function, (b) determine if the leading coefficient is POSITIVE or NEGATIVE, and (c) describe the end behavior.

13. \( p(x) = -2x^3 + 4x^2 + 8x^5 + 15 \)
14. \( g(x) = -2x^3(x^3 - 4) \)

For the function, state the interval(s) of increase and decrease.

15. [Graph]
16. [Graph]

Use the graphing calculator to complete this exercise.

1. a) Enter the function \( f(x) = 2.5x^3 - 5x^2 + 1 \)
   b) Complete the table of values.
   c) State the y-intercept.
   d) Use the Location Principle to state the real zeros.
   
   A zero occurs between _____ and _____.
   A zero occurs between _____ and _____.
   A zero occurs between _____ and _____.

   e) Use the graphing calculator to approximate the zeros. Round to the nearest hundredth.

   1st zero: ________  2nd zero: ________  3rd zero: ________

   f) Approximate the coordinates of the extrema to the nearest hundredth. Classify them as absolute or relative.

   g) Describe the end behavior.
5-1 Answers

1. \( \frac{1}{x} \) 
2. \( \frac{1}{16x^8} \) 
3. \( 16x^8 \) 
4. \( \frac{4y^4}{3} \) 
5. \( -\frac{1}{2x^4y^2z^3} \) 
6. \( 30x^{11}y^4 \) 
7. \( \frac{-28y^6}{x^2} \) 
8. \( 24x^6y^9 \) 
9. \( \frac{16y^8}{81x^{12}} \) 
10. \( \frac{27y^6}{125x^{24}} \) 
11. \( x^4y^8 \) 
12. \( \frac{1}{x^4y^8} \) 
13. \( 7c^2 - 2c - 4 \) 
14. \( -2d^2 + 3d + 16 \) 
15. \( 21x^2 - 43x - 14 \) 
16. \( 25x^2 - 10x + 1 \) 
17. \( 2x^3 + 9x^2 - 17x + 6 \) 
18. \( 6x^3 - 14x^2 - 9x + 21 \) 
19. \( P: 10x - 10; A: 6x^2 - 19x - 36 \) 
20. \( P: 4x + 9; A: x^2 + \frac{3}{2}x + 5 \)

5-2 Answers

1. \( 4ab^4 - 1 - 3a^2b \) 
2. \( a - 3b^2 + 2a^2b^3 \) 
3. \( \frac{4y^2}{x^3} + 5y^4 - \frac{3x^3}{y^3} \) 
4. \( x + 3 \) 
5. \( a - 3 + \frac{-3}{a - 2}, \text{ or } a - 3 - \frac{3}{a - 2} \) 
6. \( 4x^2 + 26x + 155 + \frac{941}{x - 6} \) 
7. \( 6x^3 + 4x^2 + 8x + 28 + \frac{42}{x - 2} \) 
8. \( 2x^2 - 3x - 2 \) 
9. \( 3x^2 + 4x - 1 + \frac{2}{5x - 4} \)

5-3 Answers

1. Yes, 8, -11 
2. No; two variables 
3. No; variable under radical 
4. Yes, 1, 1 
5. No; negative exponent 
6. No; variable in denominator 
7. 56 
8. \( 54m^6 - 27m^{15} + 14 \) 
9. \( 81a^2 + 48a + 21 \) 
10. \( 9x^2 - 74x + 166 \) 
11. a) even b) positive c) 5 d) 4 e) As \( x \to \infty \), \( f(x) \to \infty \) and as \( x \to -\infty \), \( f(x) \to \infty \) 
12. a) odd b) negative c) 4 d) 3 e) As \( x \to \infty \), \( f(x) \to -\infty \) and as \( x \to -\infty \), \( f(x) \to \infty \) 
13. a) odd b) positive c) As \( x \to -\infty \), \( f(x) \to -\infty \) and As \( x \to \infty \), \( f(x) \to \infty \) 
14. a) even b) negative c) As \( x \to -\infty \), \( f(x) \to -\infty \) and As \( x \to \infty \), \( f(x) \to -\infty \) 
15. Increase: \( (-\infty, -1) \cup (2, \infty) \) Decrease: \( (-1,2) \) 
16. Increase: \( (-\infty, -4) \cup (-1,2) \) Decrease: \( (-4, -1) \cup (2, \infty) \)

5-4 Answers

1. c) 1 
   d) A zero occurs between -1 and 0; a zero occurs between 0 and 1; a zero occurs between 1 and 2 
   e) 1st zero at -0.41; 2nd zero at 0.52; 3rd zero at 1.89 
   f) Relative Maximum of 1 at \( x = 0 \); Relative Minimum of -1.96 at \( x = 1.33 \) 
   g) As \( x \to -\infty \), \( f(x) \to -\infty \) and as \( x \to \infty \), \( f(x) \to \infty \)