**Algebra II** Name:

**Unit 3 Exam: Polynomials** Date:

**Part 1: Multiple Choice**

*In the space provided, show all work to answer each of the following questions. Carefully select the best answer to each question and print your final answers on the answer sheet provided by your teacher.*

1. Identify the degree of the monomial $-5r^{3}s^{5}$
2. $-5$
3. 3
4. 5
5. 8
6. Add: $\left(5a^{5}-a^{4}\right)+\left(a^{5}+7a^{4}-2\right)$
7. $6a^{5}+6a^{4}$
8. $6a^{10}+6a^{8}-2$
9. $6a^{5}+6a^{4}-2$
10. $5a^{5}+7a^{4}-2$
11. For $h\left(x\right)=2x^{2}+6x-9$ and $k\left(x\right)=3x^{2}-8x+8$, find $h\left(x\right)-2k\left(x\right)$
12. $-4x^{2}-22x+25$
13. $-4x^{2}+22x-25$
14. $-4x^{2}+14x-17$
15. $-4x^{2}-14x+17$
16. Find the product: $2cd^{4}\left(-4c^{6}d^{5}-c^{3}d\right)$
17. $2c^{8}d^{10}+2c^{5}d^{6}$
18. $-8c^{7}d^{9}-2c^{4}d^{5}$
19. $-8c^{6}d^{20}-2c^{3}d^{4}$
20. $-2c^{7}d^{9}+c^{4}d^{5}$
21. Find the product: $\left(5x-3\right)\left(x^{3}-5x+2\right)$
22. $5x^{4}-3x^{3}+25x^{2}-5x-6$
23. $5x^{3}-28x^{2}+25x-6$
24. $5x^{4}-3x^{3}-25x^{2}+25x-6$
25. $5x^{3}+22x^{2}-5x-6$
26. Find the product: $\left(x-2y\right)^{3}$
27. $x^{3}-6x^{2}y+12xy^{2}-8y^{3}$
28. $x^{3}+8y^{3}$
29. $x^{3}+6x^{2}y+12xy^{2}+8y^{3}$
30. $x^{3}-8y^{3}$
31. Factor: $x^{3}+5x^{2}-9x-45$
32. $\left(x+5\right)\left(x-3\right)\left(x+3\right)$
33. $\left(x-5\right)\left(x^{2}+9\right)$
34. $\left(x+5\right)\left(x^{2}+9\right)$
35. $\left(x-5\right)\left(x-3\right)\left(x+3\right)$
36. Factor the expression: $81x^{6}+24x^{3}y^{3}$
37. $3x^{3}\left(3x+2y\right)\left(9x^{2}-6xy+4y^{2}\right)$
38. $3x^{3}\left(3x+2y\right)\left(9x^{2}+6xy+4y^{2}\right)$
39. $3x^{3}\left(3x+2y\right)^{3}$
40. $3x^{3}\left(3x+2y\right)\left(27x^{3}+8y^{3}\right)$
41. Use factoring to solve the polynomial equation: $3x^{5}+6x^{4}-72x^{3}=0$
42. The roots are $0, -6, and 4$
43. The roots are $-18 and 12$
44. The roots are $0, 6, and-4$
45. The roots are $-6 and 4$
46. Write the simplest polynomial function with zeros and 
47. $p\left(x\right)=x^{3}-\frac{3}{2}x^{2}-\frac{39}{2}x+10$
48. $p\left(x\right)=x^{4}-\frac{1}{2}x^{3}-11x^{2}+\frac{1}{2}x+10$
49. $p\left(x\right)=x^{3}+5x^{2}-4x+\frac{1}{2}$
50. $p\left(x\right)=x^{3}+\frac{3}{2}x^{2}-\frac{39}{2}x-10$
51. Computer graphics programs often employ a method called *cubic splines regression* to smooth hand-drawn curves. This method involves splitting a hand-drawn curve into regions that can be modeled by cubic polynomials.

A region of a hand-drawn curve is modeled by the function $f\left(x\right)=-x^{3}+3x^{2}-4$.

Use the graph of $f\left(x\right)=-x^{3}+3x^{2}-4$ (shown below) to identify the values of *x* for which $f\left(x\right)=0$.

1. $x=-1; x=2$
2. $x=1; x=-2$
3. $x=-1; x=\pm 2$
4. This cannot be determined from the graph

**Part 2: Open-Ended**

*Show all work to answer each of the questions that follow and print your final answers on the answer sheet provided by your teacher.*

1. Consider the polynomial $12x^{2}+6-7x^{5}+3x^{3}+7x^{4}-5x$
2. Write the polynomial in standard form.
3. Identify the number of terms in the polynomial, as well as its degree and leading coefficient.
4. A florist bases the charge to have flowers delivered on how far the delivery address is from his shop. *d* represents the distance from the delivery address to the florist shop in miles. The cost to deliver flowers, based on the distance *d,* is given by the function $\left(d\right)=0.04d^{3}-0.65d^{2}+3.5d+9$.
5. Evaluate $C\left(d\right)$ for $d=6$ and for $d=11$
6. Describe what each of the values of the function in part (a) represent.
7. The right triangle shown below is enlarged such that each side is multiplied by the value of the hypotenuse, $3y$. Find the expression that represents the perimeter of the enlarged triangle.

 4*x*  3*y*

 4*x*

1. Use synthetic division to evaluate the polynomial $p\left(x\right)=x^{3}-4x^{2}+4x-5$ at $x=4$
2. Write an expression that represents the width of a rectangle with length $x+5$ and area $x^{3}+12x^{2}+47x+60$
3. Determine whether the binomial $\left(x-4\right)$ is a factor of the polynomial

$$p\left(x\right)=5x^{3}-20x^{2}-5x+20$$

1. Simplify the following: 
2. A jewelry box has a length that is 2 inches longer than the width and a height that is 1 inch shorter than the width.
3. Write expressions to represent the length, width, and height of the jewelry box
4. Write a function that models the volume of the jewelry box
5. If the volume of the box is 140 cubic inches, what is the width of the jewelry box?
6. Consider the exercise $\left(4x^{3}-16x^{2}+9x+10\right)÷\left(x-3\right)$
7. Which method is the best way to divide the polynomials? Explain why you chose this method.
8. How can you determine if you should get a remainder when you divide?

**Polynomials**

**Answer Section**

**MULTIPLE CHOICE**

 1. ANS: B

Add the exponents of the variables. 3 + 5 = 8

The degree is 8.

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Add the exponents of the variables. |
| **B** | Correct! |
| **C** | Add the exponents of the variables. |
| **D** | The degree of the monomial is the sum of the exponents of the variables. |

PTS: 1 DIF: Basic REF: 15d6ed46-4683-11df-9c7d-001185f0d2ea

OBJ: 3-1.1 Identifying the Degree of a Monomial LOC: MTH.C.10.05.08.006

TOP: 3-1 Polynomials MSC: DOK 2

 2. ANS: C

|  |  |
| --- | --- |
|  |  |
| =  | Identify like terms. Rearrange terms to get like terms together. |
| =  | Combine like terms. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Check that you have included all the terms. |
| **B** | When adding polynomials, keep the same exponents. |
| **C** | Correct! |
| **D** | First, identify the like terms and rearrange these terms so they are together. Then, combine the like terms. |

PTS: 1 DIF: Basic REF: 15db8aee-4683-11df-9c7d-001185f0d2ea

OBJ: 3-1.3 Adding and Subtracting Polynomials NAT: NT.CCSS.MTH.10.9-12.A.APR.1

STA: NJ.CCCS.MTH.02.9-12.4.3.D.1.1 LOC: MTH.C.10.05.08.03.001

TOP: 3-1 Polynomials MSC: DOK 2

 3. ANS: B

|  |  |
| --- | --- |
|  |  |
| =  | Substitute the given values. |
| =  | Distribute. |
| =  | Simplify. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Check for algebra mistakes. Multiplying by –2 changes the sign of every term in *k*(*x*). |
| **B** | Correct! |
| **C** | Check for algebra mistakes. Multiply every term in *k*(*x*) by –2. |
| **D** | Check for algebra mistakes. Multiply every term in *k*(*x*) by –2. |

PTS: 1 DIF: Advanced REF: 15e04fa6-4683-11df-9c7d-001185f0d2ea

NAT: NT.CCSS.MTH.10.9-12.A.APR.1 LOC: MTH.C.10.05.08.009

TOP: 3-1 Polynomials MSC: DOK 3

 4. ANS: B

Use the Distributive Property to multiply the monomial by each term inside the parentheses. Group terms to get like bases together, and then multiply.

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Don't forget to multiply the coefficients for each term. |
| **B** | Correct! |
| **C** | When multiplying like bases, add the exponents. |
| **D** | Multiply the coefficients for each term; don't add. |

PTS: 1 DIF: Basic REF: 15e076b6-4683-11df-9c7d-001185f0d2ea

OBJ: 3-2.1 Multiplying a Monomial and a Polynomial NAT: NT.CCSS.MTH.10.9-12.A.APR.1

STA: NJ.CCCS.MTH.02.9-12.4.3.D.1.2 LOC: MTH.C.10.05.08.03.02.002

TOP: 3-2 Multiplying Polynomials MSC: DOK 3

 5. ANS: C

|  |  |
| --- | --- |
|  |  |
| =  | Distribute  and . |
| =  | Distribute  and  again. |
| =  | Multiply. |
| =  | Combine like terms. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Check the signs. |
| **B** | Combine only like terms. |
| **C** | Correct! |
| **D** | Combine only like terms. |

PTS: 1 DIF: Average REF: 15e2b202-4683-11df-9c7d-001185f0d2ea

OBJ: 3-2.2 Multiplying Polynomials NAT: NT.CCSS.MTH.10.9-12.A.APR.1

STA: NJ.CCCS.MTH.02.9-12.4.3.D.1.2 LOC: MTH.C.10.05.08.03.02.002

TOP: 3-2 Multiplying Polynomials MSC: DOK 3

 6. ANS: A

Write in expanded form.



Multiply the last two binomial factors.



Distribute the first term, distribute the second term, and combine like terms.



|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Correct! |
| **B** | To find the product, write out the three binomial factors and multiply in two steps. |
| **C** | Remember that the second term is negative. |
| **D** | To find the product, write out the three binomial factors and multiply in two steps. |

PTS: 1 DIF: Average REF: 15e53b6e-4683-11df-9c7d-001185f0d2ea

OBJ: 3-2.4 Expanding a Power of a Binomial NAT: NT.CCSS.MTH.10.9-12.A.APR.1

TOP: 3-2 Multiplying Polynomials MSC: DOK 3

 7. ANS: A

|  |  |
| --- | --- |
|  | Group terms. |
| =  | Factor common monomials from each group. |
| =  | Factor out the common binomial. |
| =  | Factor the difference of squares. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Correct! |
| **B** | Watch your signs when factoring. |
| **C** | In the second group, factor out a negative number. |
| **D** | Watch your signs when factoring. |

PTS: 1 DIF: Average REF: 15f1273a-4683-11df-9c7d-001185f0d2ea

OBJ: 3-4.2 Factoring by Grouping NAT: NT.CCSS.MTH.10.9-12.A.SSE.2

LOC: MTH.C.10.05.08.03.04.011 TOP: 3-4 Factoring Polynomials

MSC: DOK 3

 8. ANS: A

Factor out the GCF.



Write as a sum of cubes.



Factor.

 = 

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Correct! |
| **B** | In a sum of cubes, the plus and minus signs alternate. |
| **C** | Check the formula for the sum of cubes. |
| **D** | After factoring out the GCF, see if the result can be factored further. |

PTS: 1 DIF: Basic REF: 15f36286-4683-11df-9c7d-001185f0d2ea

OBJ: 3-4.3 Factoring the Sum or Difference of Two Cubes NAT: NT.CCSS.MTH.10.9-12.A.SSE.2

LOC: MTH.C.10.05.08.03.04.005 TOP: 3-4 Factoring Polynomials

MSC: DOK 3

 9. ANS: A

|  |  |
| --- | --- |
|  | Factor out the GCF, 3*x*3. |
|  | Factor the quadratic. |
|  | Set each factor equal to 0. |
|  | Solve for *x*. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Correct! |
| **B** | Factor out the GCF first. |
| **C** | Set each factored expression equal to zero and solve. |
| **D** | Set the GCF equal to zero. |

PTS: 1 DIF: Average REF: 15f8273e-4683-11df-9c7d-001185f0d2ea

OBJ: 3-5.1 Using Factoring to Solve Polynomial Equations

NAT: NT.CCSS.MTH.10.9-12.A.APR.2 | NT.CCSS.MTH.10.9-12.A.APR.3

LOC: MTH.C.10.06.05.01.003 TOP: 3-5 Finding Real Roots of Polynomial Equations

MSC: DOK 3

 10. ANS: A

|  |  |
| --- | --- |
|  |  |
|  (*x* – 5)(*x* + 4)(*x* ) | If *r* is a zero of , then  is a factor of . |
|  ( – *x* – 20)(*x* ) | Multiply the first two binomials. |
|  *x*  | Multiply the trinomial by the binomial. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | Correct! |
| **B** | The simplest polynomial with zeros *r*1, *r*2, and *r*3 is (*x* – *r*1)(*x* – *r*2)(*x* – *r*3). |
| **C** | If r is a zero of *P*(*x*), then (*x* – *r*) is a factor of *P*(*x*). |
| **D** | If *r* is a zero of *P*(*x*), then (*x* – *r*), not (*x* + *r*), is a factor of *P*(*x*). |

PTS: 1 DIF: Average REF: 15ff4e52-4683-11df-9c7d-001185f0d2ea

OBJ: 3-6.1 Writing Polynomial Functions Given Zeros

TOP: 3-6 Fundamental Theorem of Algebra MSC: DOK 3

 11. ANS: C

The graph indicates  has zeroes at  and . By the Factor Theorem,  and  are factors of . Use either root and synthetic division to factor the polynomial. Choose the root .



|  |  |
| --- | --- |
|  | Write as a product. |
|  | Factor out –1 from the quadratic. |
|  | Factor the perfect-square quadratic. |

|  |  |
| --- | --- |
|  | **Feedback** |
| **A** | The graph decreases as *x* increases. How is this represented in the function? |
| **B** | The Factor Theorem states that if r is a root of *f*(*x*), then *x* – *r*, not *x* + *r*, is a factor of *f*(*x*). |
| **C** | Correct! |
| **D** | After identifying the roots, use synthetic division to factor the polynomial. |

PTS: 1 DIF: Average REF: 15f5c4e2-4683-11df-9c7d-001185f0d2ea

OBJ: 3-4.4 Application

NAT: NT.CCSS.MTH.10.9-12.A.APR.2 | NT.CCSS.MTH.10.9-12.F.IF.8

LOC: MTH.C.10.05.08.03.04.002 TOP: 3-4 Factoring Polynomials

MSC: DOK 4

**SHORT ANSWER**

 1. ANS:



leading coefficient: –7; degree: 5; number of terms: 6; name: quintic polynomial

The standard form is written with the terms in order from highest to lowest degree.

In standard form, the degree of the first term is the degree of the polynomial.

The polynomial has 6 terms. It is a quintic polynomial.

PTS: 1 DIF: Average REF: 15d92892-4683-11df-9c7d-001185f0d2ea

OBJ: 3-1.2 Classifying Polynomials

LOC: MTH.C.10.05.08.004 | MTH.C.10.05.08.006 | MTH.C.10.05.08.007

TOP: 3-1 Polynomials MSC: DOK 2

 2. ANS:

; .

 represents the cost, $15.24, of delivering flowers to a destination that is 6 miles from the shop.

 represents the cost, $22.09, of delivering flowers to a destination that is 11 miles from the shop.





 represents the cost, $15.24, of delivering flowers to a destination that is 6 miles from the shop.

 represents the cost, $22.09, of delivering flowers to a destination that is 11 miles from the shop.

PTS: 1 DIF: Average REF: 15dbb1fe-4683-11df-9c7d-001185f0d2ea

OBJ: 3-1.4 Application NAT: NT.CCSS.MTH.10.9-12.F.IF.2

STA: NJ.CCCS.MTH.08.9-12.4.3.D.1.5 LOC: MTH.C.10.05.08.010

TOP: 3-1 Polynomials MSC: DOK 3

 3. ANS:



measure of leg 1 

measure of leg 2 

measure of hypotenuse 





PTS: 1 DIF: Advanced REF: 15e9d916-4683-11df-9c7d-001185f0d2ea

NAT: NT.CCSS.MTH.10.9-12.A.APR.1 TOP: 3-2 Multiplying Polynomials

MSC: DOK 3

 4. ANS:



Write the coefficients of the dividend. Use .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4 | 1 | –4 | 4 | –5 |
|  |  | 4 | 0 | 16 |
|  | 1 | 0 | 4 | 11 |



PTS: 1 DIF: Basic REF: 15ee9dce-4683-11df-9c7d-001185f0d2ea

OBJ: 3-3.3 Using Synthetic Substitution STA: NJ.CCCS.MTH.08.9-12.4.3.D.1.5

LOC: MTH.C.10.07.07.02.002 TOP: 3-3 Dividing Polynomials

MSC: DOK 3

 5. ANS:



.

|  |  |
| --- | --- |
|  | Substitute. |

Use synthetic division.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| –5 | 1 | 12 | 47 | 60 |
|  |  | –5 | –35 | –60 |
|  | 1 | 7 | 12 | 0 |

The width can be represented by .

PTS: 1 DIF: Average REF: 15eec4de-4683-11df-9c7d-001185f0d2ea

OBJ: 3-3.4 Application NAT: NT.CCSS.MTH.10.9-12.A.APR.6

LOC: MTH.C.10.05.08.03.03.003 TOP: 3-3 Dividing Polynomials

MSC: DOK 3

 6. ANS:

() is a factor of the polynomial .

Find  by synthetic substitution.



Since ,  is a factor of the polynomial .

PTS: 1 DIF: Average REF: 15f1002a-4683-11df-9c7d-001185f0d2ea

OBJ: 3-4.1 Determining Whether a Linear Binomial is a Factor

NAT: NT.CCSS.MTH.10.9-12.A.SSE.2 STA: NJ.CCCS.MTH.08.9-12.4.3.D.1.5

LOC: MTH.C.10.07.07.02.002 TOP: 3-4 Factoring Polynomials

MSC: DOK 3

 7. ANS:

2x-5

PTS: 1

 8. ANS:

5 in.

Let *x* be the width in inches. The length is , and the height is .

**Step 1** Find an equation.

|  |  |
| --- | --- |
|  | Volume is the product of the length, width, and height. |
|  | Multiply the left side. |
|  | Set the equation equal to 0. |

**Step 2** Factor the equation, if possible.

|  |  |
| --- | --- |
| Factors of –140: , , , , , , , , , , , . | Rational Root Theorem |

Use synthetic substitution to test the positive roots (length can’t be negative) to find one that actually is a root.

|  |  |
| --- | --- |
|  | The synthetic substitution of 5 results in a remainder of 0. 5 is a root.  |
|  | Use the Quadratic Formula to factor .The roots are complex. |
| Width = 5 in. | Width must be a positive real number. |

PTS: 1 DIF: Average REF: 15fab0aa-4683-11df-9c7d-001185f0d2ea

OBJ: 3-5.3 Application NAT: NT.CCSS.MTH.10.9-12.A.APR.3

LOC: MTH.C.10.06.05.01.005 | MTH.C.10.06.05.005

TOP: 3-5 Finding Real Roots of Polynomial Equations MSC: DOK 4

 9. ANS:

sdfasf

PTS: 1