

Unit 1-3: Exponents, Polynomials & Factoring

Simplify each expression.

1.  $(x^2y)(x^3y^4)$

2.  $\frac{x^2}{x^5}$

3.  $-(9x)^0$

4.  $(3y^4)^3$

$x^5y^5$   
 $x^{-3}$   
 $= \frac{1}{x^3}$

$-1$

$27y^{12}$

5.  $\frac{3x^2y^{-3}}{12x^6y^3}$

7.  $(\frac{4x^5y}{16xy^4})^3$

6.  $(2cd^4)^2(cd)^5$

$(\frac{1x^4}{4y^3})^3$

$4c^2d^8 \cdot c^5d^5$

$= 4c^7d^{13}$

$\frac{1x^{12}}{64y^9}$

Add or subtract.

8.  $(5p^2 - 3) + (2p^2 - 3p^3)$

9.  $(-9v^2 - 8u) + (-2uv - 2u^2 + v^2) - (-v^2 + 4uv)$

$7p^2 - 3 - 3p^3$

$-7v^2 - 8u - 6uv - 2u^2$

10.  $(-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$

11.  $(4n - 3n^3) - (3n^3 + 4n)$

$-2x^5 + 14 + 5x + 10x^4$

$-6n$

Find the product.

12.  $-3x(x^2 - 7x + 1)$

13.  $-2x^3(3x^2 + 4x) + 9x^3(x^2 + x + 1)$

$-3x^3 + 21x^2 - 3x$

$-6x^5 - 8x^4 + 9x^5 + 9x^4 + 9x^3$

$= 3x^5 + x^4 + 9x^3$

14.  $(x+6)(x-8)$

$x^2 - 2x - 48$

15.  $(4x+2y)^2$

$(4x+2y)(4x+2y)$

$9x^2 - 25$

$16x^2 + 16xy + 4y^2$

} Box  
or  
FOIL

17.  $(5x-3)(2x-1)$

$10x^2 - 11x + 3$

18.  $(x+5)(5x+2)$

$5x^2 + 27x + 10$

Factor Completely.

19.  $12a^2b^2 - 3ab$

$3ab(4ab - 1)$

20.  $2x^5 - 8x^3$

$2x^3(x^2 - 4)$

21.  $x^2 + 5x + 6$

$(x+2)(x+3)$

22.  $6a^2 - 11a + 4$

$(2a-1)(3a-4)$

23.  $xy + 8x + 3y + 24$

$(y+8)(x+3)$

24.  $3x^4 - 18x^3 + 27x^2$

$3x^2(x^2 - 6x + 9)$

$3x^2(x-3)(x-3)$

$= 3x^2(x-3)^2$

25.  $4x^2 - 9$

$(2x+3)(2x-3)$

26. Which expression is equivalent to  $\frac{(2a^2)^3 (b^{-4})}{b}$ ?

A.  $\frac{8a^6}{b^5}$

B.  $\frac{2a^6}{b^5}$

C.  $8a^5b^6$

D.  $8a^6b^3$

28. What is the factored form of the expression,  $8xy^2z^2 + 12x^2y$ ?

A.  $4y(3x^2 + 2xyz^2)$

B.  $4xy(3x + 2yz^2)$

C.  $(4xy + 1)(3x + 2yz^2)$

D.  $96x^3(y^3)(z^2)$

30. What is the simplest form of the expression,  $(3x^2y^7z^3)^0$ ?

A.  $3x^2y^7z^3$

B.  $126x^2y^7z^3$

C. 0

D. 1

27. A triangle with a perimeter of  $23x - 7$  has two sides with lengths of  $5x + 7$  and  $8x - 9$ . What is the length of the third side?

A.  $14x - 2$

B.  $37x - 9$

C.  $3x - 16$

D.  $10x - 5$

29. What is the GCF of the expression,  $56x^2 - 28x$ ?

A. 7

B. 8

C.  $28x$

D.  $56x$

31. The algebraic expression can be simplified.

$(4x^3 + 2x^2 - x + 1) - (3x^3 + 2x - 5)$

Which expression is equivalent to this expression?

A.  $x^3 + 2x^2 - 3x + 6$

B.  $x^3 + 2x^2 - x - 4$

C.  $7x^3 + 2x^2 + x - 4$

D.  $7x^3 + 3x^2 - 3x + 6$

32. Mrs. Witherspoon wrote the polynomial expression in the box on the board.

$(9a^2b^3c^5)(-6b^2c^3)$

Which is equivalent to the expression in the box?

A.  $-54abc^2$

B.  $-54a^2b^5c^8$

C.  $3bc^2$

D.  $3a^2b^6c^{15}$

34. Which pair of expressions are equivalent?

A.  $3(2x - 3y); 6x - 3y$

B.  $12x - (x + y); 11x + y$

C.  $x(x + 2y); 2x + 2xy$

D.  $4x - (2x - 2y); 2x + 2y$

36. What is the product of  $(5x - 8)$  and  $(3x - 2)$ ?

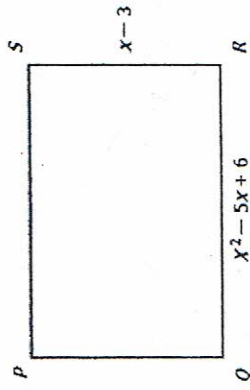
A.  $15x^2 - 34x + 16$

B.  $15x^2 - 14x - 16$

C.  $15x^2 + 34x + 16$

D.  $15x^2 + 14x - 16$

33. The length and width of a rectangle PQRS is  $x^2 - 5x + 6$  and  $x - 3$ .



What is the perimeter of rectangle PQRS?

A.  $x^2 - 4x + 3$

B.  $2x^2 - 8x + 6$

C.  $2x^2 - 12x - 6$

D.  $2x^2 - 12x + 6$

35. A polynomial expression is written in the box.

$-4a^3(-7a - 3)$

Which choice is equivalent to this expression?

A.  $28a^4 - 3$

B.  $-28a^4 + 3a^3$

C.  $28a^4 + 12a^3$

D.  $-28a^4 - 12a^3$

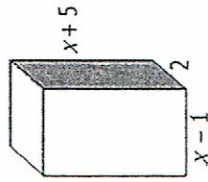
37. What is an equivalent to the expression  $(x - 3y)^2$ ?

- A.  $x^2 + 6xy + 9y^2$   
 B.  $x^2 - 6xy + 9y^2$   
 C.  $x^2 + 9y^2$   
 D.  $x^2 - 9y^2$

39. Which expression is a factor of both  $x^2 + 3x - 10$  and  $x^2 - 5x + 6$ ?

- A.  $x + 5$   
 B.  $x - 2$   
 C.  $x - 3$   
 D.  $x - 5$

38. A box has the dimensions shown in the diagram.



Which expression represents the volume of the box?

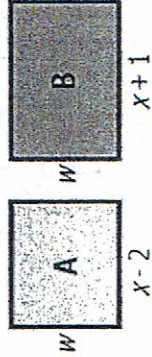
- A.  $2x^2 - 10x + 8$   
 B.  $2x^2 + 10x - 8$   
 C.  $2x^2 - 8x + 10$   
 D.  $2x^2 + 8x - 10$

42. What is the correct factorization of the polynomial in the box?

$$64b^2 - 144$$

- A.  $(8b - 18)(8b + 8)$   
 B.  $(32b - 8)(2b + 18)$   
 C.  $(8b + 12)(8b - 12)$   
 D.  $(16b - 12)(4b + 12)$

42. Rectangles A and B have the lengths shown in the diagram. They share the same width,  $w$ .



If the area of rectangle B is  $x^2 - 2x - 3$  square units, what is the area of rectangle A?

- A.  $x^2 - 6x + 5$   
 B.  $x^2 - 5x + 6$   
 C.  $x^2 + 6x - 5$   
 D.  $x^2 + 5x - 6$

43. You have a square yard with a side length of  $x + 5$ . There is a square brick covered patio in the yard with a side length of  $x$ . What is the area of the uncovered portion of the yard?

- A.  $2x^2 + 5x + 25$   
 B.  $10x + 25$   
 C.  $2x^2 + 10x$   
 D.  $x^2 + 10x + 25$

### Unit 4- Quadratic Functions

Steps to Solve a Quadratic Function by Factoring

- a. Put in standard form (poly = 0)  
 b. factor polynomial  
 c. zero product property (factors = 0)  
 d. Solve for x

Solve each quadratic equation by factoring.

1.  $(x - 6)(x - 3) = 0$   
 $x - 6 = 0$     $x - 3 = 0$   
 $x = 6$     $x = 3$   
 $\{6, 3\}$

2.  $x^2 + 5x + 4 = 0$   
 $(x + 4)(x + 1) = 0$   
 $x + 4 = 0$     $x + 1 = 0$   
 $x = -4$     $x = -1$   
 $\{-4, -1\}$

41. Which expression is equivalent to  $9a^2 + 12a + 4$ ?

- A.  $(2a - 3)^2$   
 B.  $(2a + 3)^2$   
 C.  $(3a - 2)^2$   
 D.  $(3a + 2)^2$

3.  $x^2 - 64 = 0$

$(h+8)(h-8) = 0$   
 $h+8=0$   $h-8=0$   
 $h=-8$   $h=8$   
 $\{-8, 8\}$

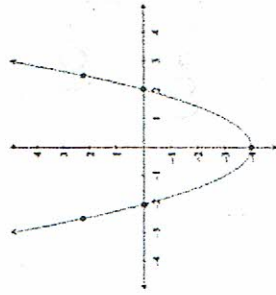
5.  $k^2 + 15k = -56$

$k^2 + 15k + 56 = 0$   
 $(k+7)(k+8) = 0$   
 $k+7=0$   $k+8=0$   
 $k=-7$   $k=-8$   
 $\{-7, -8\}$

7.  $x^2 + 17x + 49 = 3x$

$x^2 + 14x + 49 = 0$   
 $(x+7)(x+7) = 0$   
 $x+7=0$   $x+7=0$   
 $x=-7$   $x=-7$   
 $\{-7\}$  Double Root

9. The graph of a quadratic function is shown in the coordinate grid.



What are the roots of the function?

- A.  $x = -2$  and  $x = 2$
- B.  $x = -4$  and  $x = 0$
- C.  $x = -2$  and  $x = 0$
- D.  $x = 0$  and  $x = 2$

4.  $x^2 = 11x - 28$

$x^2 - 11x + 28 = 0$   
 $(x-7)(x-4) = 0$   
 $x-7=0$   $x-4=0$   
 $x=7$   $x=4$   
 $\{7, 4\}$

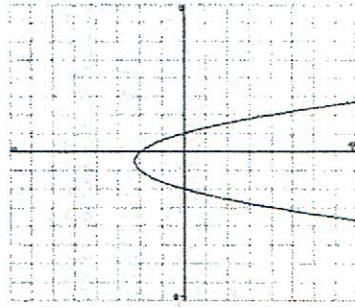
6.  $m^2 = 2m$

$m^2 - 2m = 0$   
 $m(m-2) = 0$   
 $m=0$   $m-2=0$   
 $\{0, 2\}$

8.  $10x^2 - 26x = -12$

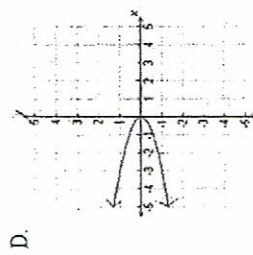
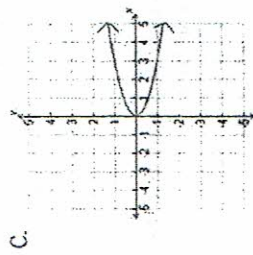
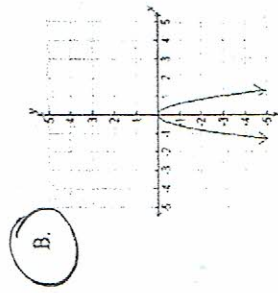
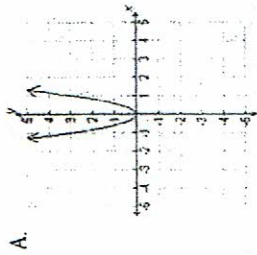
$10x^2 - 26x + 12 = 0$   
 $2(5x^2 - 13x + 6) = 0$   
 $2(5x-3)(x-2) = 0$   
 $5x-3=0$   $x-2=0$   
 $\{3/5, 2\}$

10. Which choice is most likely the equation of this quadratic function?

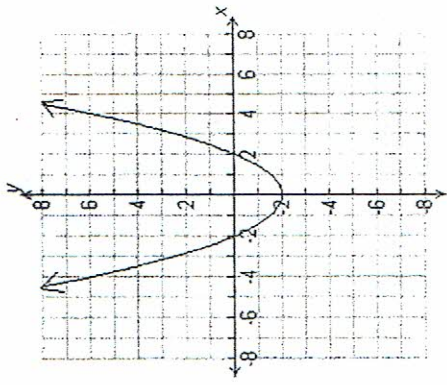


- A.  $y = x^2 - x + 2$
- B.  $y = -x^2 - x + 2$  Flipped.
- C.  $y = x^2 + x^2$
- D.  $y = -x^2 + x - 2$

11. What is the graph of the function  $f(x) = -3x^2$ ?



12. A function is graphed on the coordinate grid.



Which statement about the function represented in the graph is true?

- A. The function is linear.
- B. The function is quadratic.
- C. The value of the function at  $x = 0$  is 2.
- D. The value of the function at  $x = 6$  is 4.

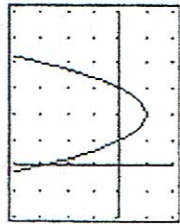
13. A quadratic equation is given.

$y = x^2 + 6x + 5$

What are the function's zeros?

- A. -5 and -1
  - B. 5 and 1
  - C. 2 and 3
  - D. -2 and -3
- Handwritten work:  
 $0 = x^2 + 6x + 5$   
 $0 = (x+5)(x+1)$   
 $0 = x+5$   $0 = x+1$   
 $x = -5$   $x = -1$   
 $\{-5, -1\}$

14. The graph of the quadratic equation,  $y = x^2 - 4x + 3$  is shown.



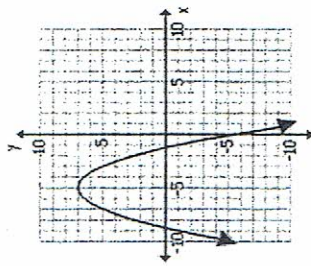
What are the x-intercepts of this graph?

- A. no x-intercepts  
 B. (1, 0) and (3, 0)  
 C. (3, 0)  
 D. The x-intercepts cannot be determined from the given graph.

15. Which quadratic function has a vertex in quadrant III?

- A.  $y = -x^2 - 5x + 7$   
 B.  $y = 3x^2 + 12x + 8$   
 C.  $y = x^2 - 6x + 2$   
 D.  $y = -2x^2 + 12x - 14$
- Use Calc.*

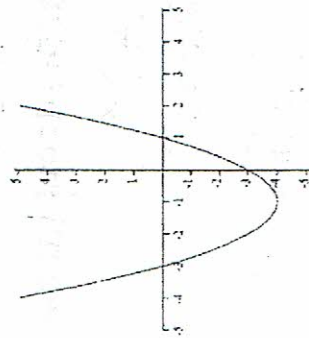
16. A quadratic function is shown.



What is the vertex and axis of symmetry of this function?

- A. vertex (-5, 7)  
axis of symmetry  $x = 7$   
 B. vertex (5, 7)  
axis of symmetry:  $x = 5$   
 C. vertex (-5, 7)  
axis of symmetry:  $x = -5$   
 D. vertex (5, 7)  
axis of symmetry:  $x = 7$

18. A graph of a quadratic function is shown in the coordinate grid.



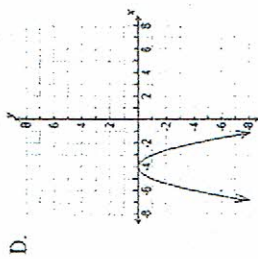
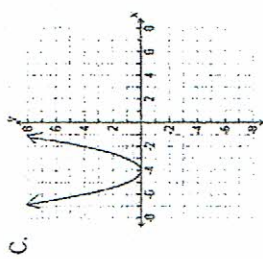
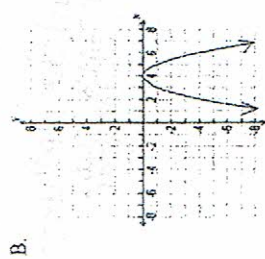
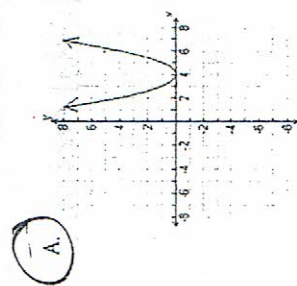
Which choice represents the correct intercepts and vertex for this graph?

- A. x-intercept -1; y-intercepts -3 and 1; vertex (-4, 0)  
 B. x-intercepts -3 and 1; y-intercept -3; vertex (-1, -4)  
 C. x-intercepts 1 and -3; y-intercept 0; vertex (-3, 0)  
 D. x-intercept -4; y-intercepts -3 and 1; vertex (-1, 3)

20. If an object is dropped from the height of 54 feet, the function  $h = -16t^2 + 54$  gives the height of the object after  $t$  seconds. Approximately how long will it take before the object hits the ground?

- A. 2.45 seconds  
 B. 1.84 seconds  
 C. 1.30 seconds  
 D. 0.75 seconds
- Graph in Calc and find zeros.*

19. Which picture is the graph of the function  $f(x) = (x - 4)^2$ ?



17. The height ( $y$ ), in feet, of a ball thrown into the air can be modeled by the function  $y = -2.2x^2 + 5.3x + 4$ , with  $x$  representing the horizontal distance traveled. What is the maximum height reached by the ball?

- A. 9.3 feet  
 B. 8.6 feet  
 C. 7.2 feet  
 D. 3.1 feet
- Use Calc.*

Unit 5- Exponential Functions

Explicit Equation for an Exponential Function:  $y = a \cdot b^x$

$a =$  initial amount       $b =$  growth/decay factor

Explicit Equation for Percent Growth:  $y = a(1+r)^x$

Explicit Equation for Percent Decay:  $y = a(1-r)^x$

\*Remember, there could be a time interval (n), in which the exponent is a fraction:  $\frac{x}{n} \cdot h \cdot x$

Formula for Compounded Interest:  $y = a(1 + \frac{r}{n})^{h \cdot x}$

$a =$  initial amount       $r =$  percent interest (as a decimal)

$n =$  # times occurs in one year       $x =$  time in years

1. For the given value of  $x$ , which choice has the greater value?

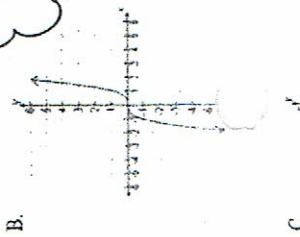
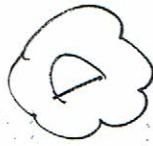
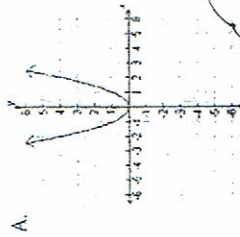
A.  $y = 3^x$  if  $x = 7$

B.  $f(x) = 4 \cdot 9^x$  if  $x = 3$

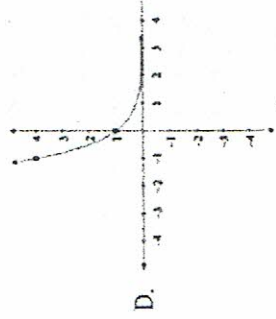
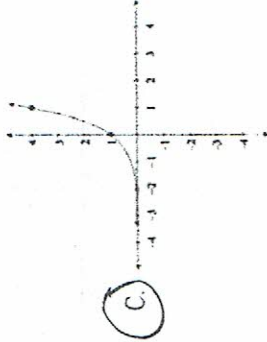
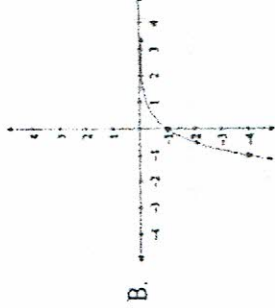
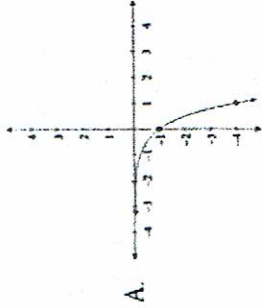
C.  $y = 7^x$  if  $x = 4$

D.  $f(x) = 10 \cdot 3^x$  if  $x = 5$

3. Which picture is the graph of the function  $f(x) = 2^x$ ?



Which is the graph of  $y = 4^x$ ?



5.

A ball is dropped to the ground from a certain height. The expression  $25(0.93)^x$  gives the height of the ball after  $x$  number of bounces.

What is the percent rate of change in the height of the ball after each bounce?

A. 7% decrease

B. 7% increase

C. 93% decrease

D. 93% increase

6. A student conducted an experiment on the change in the population of a colony of bacteria based on a change in its surrounding temperature. He modeled the change in the population using the function  $100(1 - 0.15)^4$ . Which of these statements is true?

A. The population decreases by a factor of 0.15.

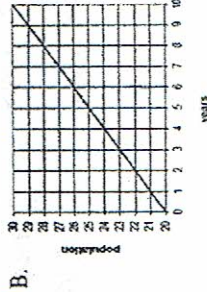
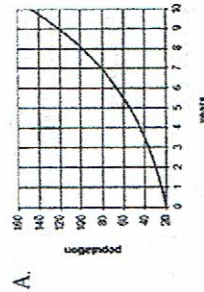
B. The population increases by a factor of 0.15.

C. The population decreases by a factor of 0.85.

D. The population increases by a factor of 0.85.

7.

4. A population of 20 rabbits increases exponentially over a period of 10 years. Which graph best fits this growth model?



8. Sally deposited \$500 into a savings account for 4 years. The amount increases at the rate of 10% per year.

Which function represents the amount in the account at the end of 4 years?

- A.  $y = 500(1.10)^4$   
B.  $y = 500(0.10)^4$   
C.  $y = 500(0.90)^4$   
D.  $y = 500(1.90)^4$

9. A total of 128 teams participated in a football league. Half the teams were eliminated after each round.

Which function represents the number of teams left in the league after the 4<sup>th</sup> round?

- A.  $y = 128(1.50)^4$   
 B.  $y = 128(0.50)^4$   
C.  $y = 128(50)^4$   
D.  $y = 128(150)^4$

10. The population of a certain town is 158,260 and increases exponentially at the rate of 6% every year.

Which equation *best* represents the population after  $x$  years?

- A.  $y = 158,260 (0.06)^x$   
B.  $y = 158,260 (0.94)^x$   
 C.  $y = 158,260 (1.06)^x$   
D.  $y = 158,260 (1.6)^x$