

Algebra 1

Lesson 20 Factor Polynomials

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In Algebra 1, students master graphing, simultaneous equations, exponents, polynomials, unit multipliers, and other Algebra 1 topics.

These Algebra 1 Sample Pages will give you an idea of Math-U-See's unique method of instruction. However, the cornerstone of Math-U-See's success is our multi-sensory approach to maths instruction. Integrated Manipulatives and Lesson-by-Lesson DVDs are used in every lesson throughout Algebra 1 to incorporate kinaesthetic, visual and auditory learning.

If you believe that Algebra 1 is the level for your student to begin, please confirm this by completing our free online placement tests.

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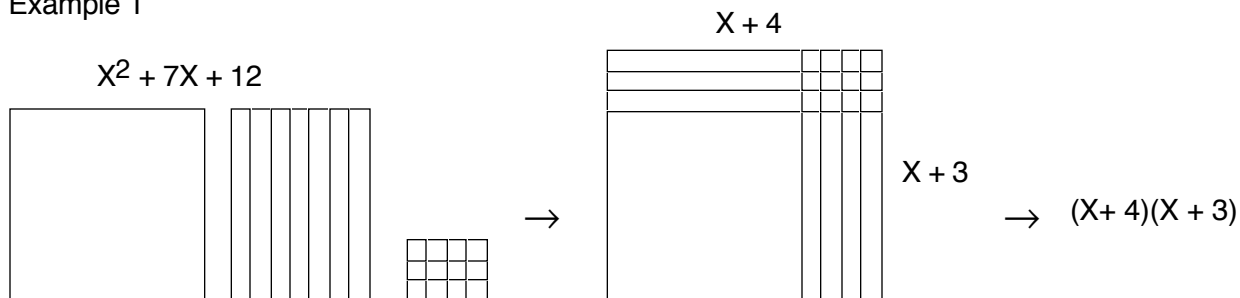


Lesson 20 Factor Polynomials

Factoring Trinomials We will be finding the factors of $X^2 + 7X + 12$ using the blocks with the algebra inserts snapped into the back. This is the opposite of multiplying two binomials to find the product, which is a trinomial. In Lesson 19 you were given the factors, and you were to find the product. Now, you are given the product and are asked to find the factors.

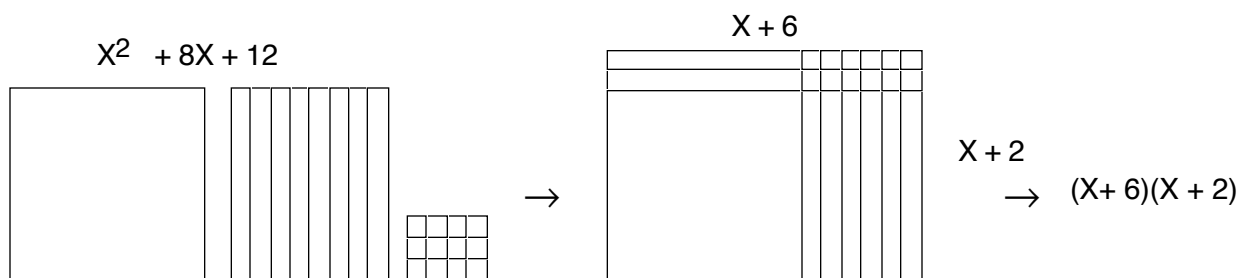
First build $X^2 + 7X + 12$. This is the product, which is given. Now build a rectangle using all the blocks. Then find the factors by reading the length of the over dimension and the up dimension.

Example 1



Example 2

Now find the factors of $X^2 + 8X + 12$. Represent with the manipulatives, build a rectangle, and read the factors.



Notice the relationship between the last term (12), the middle term (7X or 8X), and the factors. This always works when the coefficient of X^2 is 1.

$$X^2 + 7X + 12 = (X + 4)(X + 3) \quad \begin{array}{l} \text{The last term is found by multiplying } 3 \times 4. \\ \text{The middle term by adding } 3X + 4X. \end{array}$$

$$X^2 + 8X + 12 = (X + 6)(X + 2) \quad \begin{array}{l} \text{The last term is found by multiplying } 6 \times 2. \\ \text{The middle term by adding } 6X + 2X. \end{array}$$

The factors of the last term are the addends of the middle term.

Build a rectangle and find the factors. Check by multiplying.

1) $x^2 + 4x + 4$

2) $x^2 + 5x + 6$

3) $x^2 + 11x + 10$

4) $x^2 + 6x + 8$

5) $x^2 + 8x + 7$

6) $x^2 + 8x + 12$

7) $x^2 + 12x + 11$

8) $x^2 + 7x + 6$

9) $x^2 + 9x + 14$

10) $x^2 + 16x + 15$

11) $x^2 + 3x + 2$

12) $x^2 + 4x + 3$

13) $x^2 + 9x + 8$

14) $x^2 + 19x + 18$

15) $x^2 + 9x + 20$

16) $x^2 + 10x + 21$

Find the factors and check by multiplying. (You will not have enough blocks to build some of these)

1) $x^2 + 10x + 16$

2) $x^2 + 11x + 28$

3) $x^2 + 13x + 22$

4) $x^2 + 7x + 12$

5) $x^2 + 8x + 15$

6) $x^2 + 11x + 30$

7) $x^2 + 5x + 4$

8) $x^2 + 6x + 5$

9) $x^2 + 8x + 16$

10) $x^2 + 12x + 20$

11) $x^2 + 11x + 18$

12) $x^2 + 17x + 30$

13) $x^2 + 7x + 10$

14) $x^2 + 2x + 1$

15) $x^2 + 10x + 25$

16) $x^2 + 26x + 25$

Build a rectangle and find the factors.

1) $X^2 + 7X + 12 = (\quad + \quad)(\quad + \quad)$

2) $X^2 + 10X + 16 = (\quad + \quad)(\quad + \quad)$

3) $X^2 + 11X + 24 = (\quad + \quad)(\quad + \quad)$

4) $X^2 + 8X + 12 = (\quad + \quad)(\quad + \quad)$

Build a rectangle and find the area (product)

5) $(X + 4)(X + 2) =$

6) $(X + 5)(X + 3) =$

7) Find the factors: $X^2 + 7X + 6$

8) Check #7 by multiplying the factors to find the product.

9) Find the factors: $X^2 + 2X + 1$

10) Check #9 by multiplying the factors to find the product.

Add.

11)
$$\begin{array}{r} 2X^2 - 7X - 3 \\ + X^2 + 5X + 9 \\ \hline \end{array}$$

12)
$$\begin{array}{r} 6X^2 + 2X + 1 \\ + X^2 - 4X + 3 \\ \hline \end{array}$$

13) Simplify: $(P-4)^2 P^3 P^1$

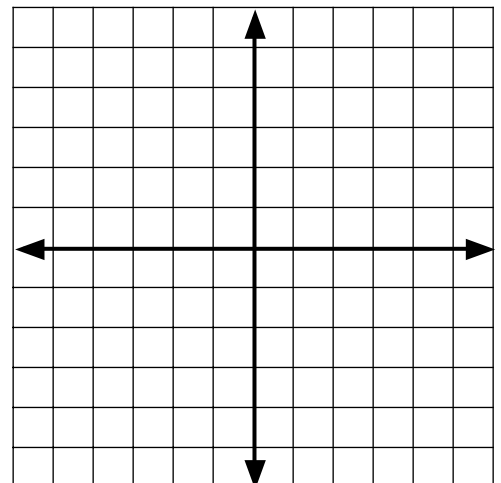
14) Simplify: $(R-2S^3)^{-3}$

15) $15^2 =$

16) $\sqrt{16} =$

17) Find three consecutive odd integers such that eleven times the first, plus two times the second, equals six times the third, plus one.

18) Nine coins, made up of 5 and 10 cent coins, have a value of \$.60. How many of each?

19) Express using the standard form of an equation of a line:
 $Y = 7X + 3$ 20) Graph: $4Y < 3X - 5$ 

Build a rectangle and find the factors.

1) $X^2 + 11X + 28 = (\quad + \quad)(\quad + \quad)$

2) $X^2 + 4X + 4 = (\quad + \quad)(\quad + \quad)$

3) $X^2 + 6X + 8 = (\quad + \quad)(\quad + \quad)$

4) $X^2 + 8X + 16 = (\quad + \quad)(\quad + \quad)$

Build a rectangle and find the area (product)

5) $(X + 5)(X + 1) =$

6) $(X + 3)(X + 3) =$

7) Find the factors: $X^2 + 12X + 32$

8) Check #7 by multiplying the factors to find the product.

9) Find the factors: $X^2 + 20X + 100$

10) Check #9 by multiplying the factors to find the product.

Add.

$$\begin{array}{r} 11) \quad X^2 + X - 4 \\ \quad + X^2 + 3X + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 12) \quad 2X^2 + 7X + 6 \\ \quad + 5X^2 - 4X + 10 \\ \hline \end{array}$$

13) Simplify: $[(P^5)^3]^{-2}$

14) Simplify: $(S^6 R^{-3} S^2)^0$

15) $11^2 =$

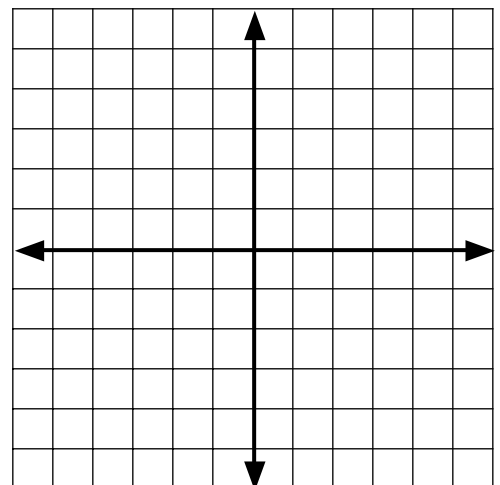
16) $\sqrt{144} =$

17) Find three consecutive odd integers such that fourteen times the second, plus four times the first, equals twelve times the third, minus two.

18) Twenty-seven coins, made up of 5 and 10 cent coins, add up to \$1.80. How many of each?

19) Graph the line $Y = \frac{3}{2} X - 1$

20) Graph a line perpendicular to #19 through (3, -3).



Build a rectangle and find the factors.

1) $X^2 + 8X + 7 = (\quad + \quad)(\quad + \quad)$

2) $X^2 + 5X + 6 = (\quad + \quad)(\quad + \quad)$

3) $X^2 + 9X + 20 = (\quad + \quad)(\quad + \quad)$

4) $X^2 + 8X + 15 = (\quad + \quad)(\quad + \quad)$

Build a rectangle and find the area (product)

5) $(X + 1)(X + 9) =$

6) $(X + 7)(X + 2) =$

7) Find the factors: $X^2 + 7X + 12$

8) Check #7 by multiplying the factors to find the product.

9) Find the factors: $X^2 + 10X + 21$

10) Check #9 by multiplying the factors to find the product.

Add.

11)
$$\begin{array}{r} 4X^2 - 4X + 1 \\ + X^2 + 2X - 1 \\ \hline \end{array}$$

12)
$$\begin{array}{r} 2X^2 + 3X + 3 \\ + X^2 + 7X - 2 \\ \hline \end{array}$$

13) Simplify: $(P^3)^0 P^4 P^{-1}$

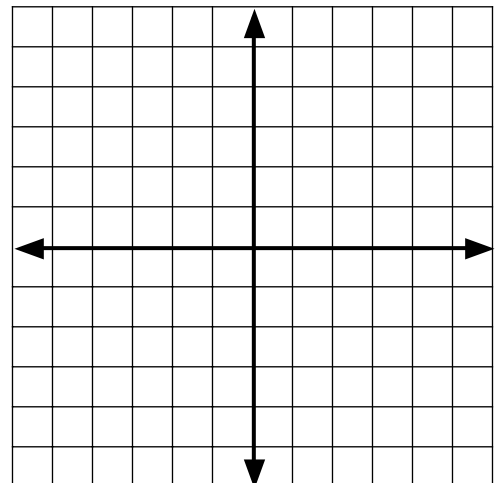
14) Simplify: $(S^2 R^0 S^0)^{-2} R^5$

15) $13^2 =$

16) $\sqrt{25} =$

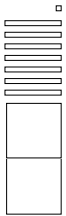
17) Find three consecutive integers such that the second, plus seven times the third, equals five times the first.

18) Twenty coins, made up of five cent coins and old one cent coins, add up to \$.76. How many of each?

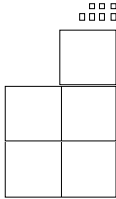
19) Rewrite in slope-intercept form: $4Y + 3X = 16$ 20) Graph: $2Y \geq 3X - 2$ 

- 1) If $(X + A)$ is multiplied times $(X + B)$, the final term of the resulting trinomial will be
 (A) X^2 (B) $(A + B)X$ (C) BX (D) AX
 (E) AB
- 2) If $(X + A)$ is multiplied times $(X + B)$, the middle term of the resulting trinomial will be
 (A) X^2 (B) $(A + B)X$ (C) BX (D) AX
 (E) AB
- 3) The factors of $X^2 + 3X + 2$ are
 (A) $(X + 3)(X + 2)$ (B) $(X + 1)(X + 2)$
 (C) $X(X + 2)$ (D) $(X + 5)(X + 2)$
 (E) $(X - 1)(X + 2)$
- 4) The factors of $X^2 + 8X + 15$ are
 (A) $(X + 2)(X + 4)$ (B) $(X + 1)(X + 8)$
 (C) $(X + 10)(X + 5)$ (D) $(X + 7)(X + 8)$
 (E) $(X + 3)(X + 5)$
- 5) The factors of $X^2 + 12X + 36$ are
 (A) $(X + 3)(X + 4)$ (B) $(X + 6)(X + 6)$
 (C) $(X + 6)(X + 2)$ (D) $(X + 18)(X + 18)$
 (E) $(X - 6)(X + 6)$
- 6) The factors of $X^2 + 12X + 20$ are
 (A) $(X + 12)(X - 20)$ (B) $(X + 2)(X + 10)$
 (C) $X(X + 20)$ (D) $(X + 5)(X + 4)$
 (E) $(X + 12)(X + 20)$
- 7) The factors of $X^2 + 11X + 24$ are
 (A) $(X + 4)(X + 6)$ (B) $(X + 2)(X + 12)$
 (C) $(X + 3)(X + 8)$ (D) $(X + 1)(X + 24)$
 (E) $(X + 5)(X + 6)$
- 8) The factors of $X^2 + 6X + 5$ are
 (A) $(X + 2)(X + 3)$ (B) $(X + 1)(X + 6)$
 (C) $X(X + 6)$ (D) $(X + 1)(X + 5)$
 (E) $(X + 5)(X + 6)$
- 9) The factors of $X^2 + 14X + 49$ are
 (A) $(X + 7)(X + 7)$ (B) $(X + 1)(X + 49)$
 (C) $X(X + 7)$ (D) $(X + 2)(X + 7)$
 (E) $(X + 1)(X + 14)$
- 10) The factors of $X^2 + 11X + 10$ are
 (A) $(X + 2)(X + 5)$ (B) $(X + 1)(X + 10)$
 (C) $X(X + 10)$ (D) $(X + 1)(X + 11)$
 (E) $(X + 5)(X + 5)$
- 11) $(A + B)(A + B)$ is equal to
 (A) $A^2 + BA + B^2$ (B) $A^2 + 2BA + AB^2$
 (C) $A^2 + 2BA + (AB)^2$ (D) $A^2 + 2BA + B^2$
 (E) $A^2 + A + B + B^2$
- 12) $(X + BY)(X + BY)$ is equal to
 (A) $X^2 + 2BYX + BY^2$ (B) $X^2 + BYX + (BY)^2$
 (C) $X^2 + 2BY + (BY)^2$ (D) $X^2 + 2BY + BY^2$
 (E) $X^2 + 2BYX + (BY)^2$
- 13) What are the factors of $X^2 + (R + T)X + RT$?
 (A) $(X + X)(X + T)$ (B) $(R + X)(T + X)$
 (C) $(X + R)(X + T)$ (D) $X(R + T)$
 (E) $(R + T)(R + T)$
- 14) What are the factors of $X^2 + 2RX + R^2$?
 (A) $(X + 2)(X + 2R)$ (B) $(X + R)(X + R)$
 (C) $(X + 2R)(X + 2R)$ (D) $X(RX + R)$
 (E) $(R + X)(R + X)$
- 15) Fill in the blank: The numbers that are added to get the coefficient of the middle term are the _____ of the last term.
 (A) exponents (B) factors (C) inverse
 (D) addends (E) products

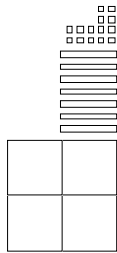
1) $\frac{X^2 + 3X - 2}{X^2 + 4X + 3} \times \frac{2X^2 + 7X + 1}{2X^2 + 7X + 1}$



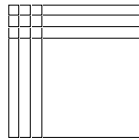
2) $\frac{3X^2 + 2X - 1}{2X^2 - 2X + 8} \times \frac{5X^2 + 7}{5X^2 + 7}$



3) $\frac{5X^2 + 4X + 7}{-X^2 + 3X + 7} \times \frac{4X^2 + 7X + 14}{4X^2 + 7X + 14}$



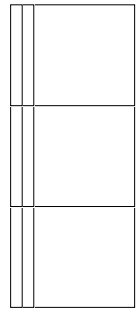
4) $(X + 3)(X + 3) = X^2 + 6X + 9$



5) $(2X + 4)(X + 2) = 2X^2 + 8X + 8$



6) $(3X)(X + 2) = 3X^2 + 6X$



7) $\frac{2X - 3}{X - 2} \times \frac{-4X + 6}{2X^2 - 3X}$

8) $\frac{X - 1}{X - 6} \times \frac{-6X + 6}{X^2 - X}$

9) $\frac{2X + 2}{X - 3} \times \frac{-6X - 6}{2X^2 + 2X}$

10) X^{-5}

11) $\frac{1}{Y^2}$

12) $7^{-2+5(-2)} = 7^5$

13) A^7B^{-3}

14) $5^{2^5} = 5^{10}$

15) $(5^3)^4$

16) $+13, -13$

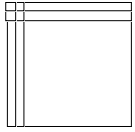
17) $C^{-4+3}D^{-3+8-7} = C^{-1}D^{-2}$

18) $\frac{3N + 4}{2N + 5} + \frac{5N + 9}{2N + 5}$

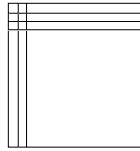
19) $5(10) + 9 = \$59$

20) $\frac{2Y + 7}{7Y + 5} \times \frac{10Y + 35}{14Y^2 + 49Y}$

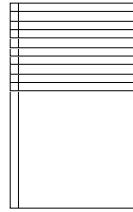
1) $\frac{X + 2}{X + 2} \times \frac{2X + 4}{X^2 + 2X}$



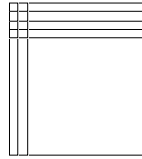
2) $\frac{X + 3}{X + 2} \times \frac{2X + 6}{X^2 + 3X}$



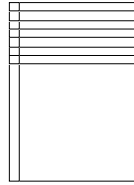
3) $\frac{X + 10}{X + 1} \times \frac{X + 10}{X^2 + 10X}$



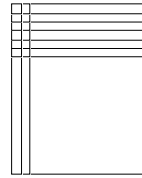
4) $\frac{X + 4}{X + 2} \times \frac{2X + 8}{X^2 + 4X}$



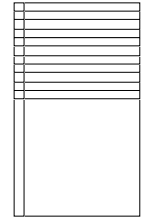
5) $\frac{X + 7}{X + 1} \times \frac{X + 7}{X^2 + 7X}$



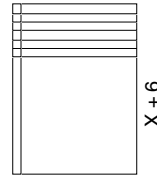
6) $\frac{X + 6}{X + 2} \times \frac{2X + 12}{X^2 + 6X}$



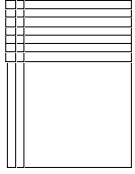
7) $\frac{X + 11}{X + 1} \times \frac{X + 11}{X^2 + 11X}$



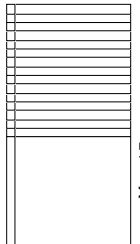
8) $\frac{X + 6}{X + 1} \times \frac{X + 6}{X^2 + 2X}$



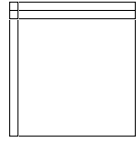
9) $\frac{X + 7}{X + 2} \times \frac{2X + 14}{X^2 + 7X}$



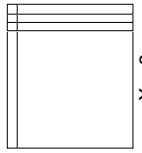
10) $\frac{X + 15}{X + 1} \times \frac{X + 15}{X^2 + 15X}$



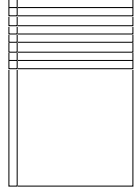
11) $\frac{X + 2}{X + 1} \times \frac{X + 2}{X^2 + 2X}$



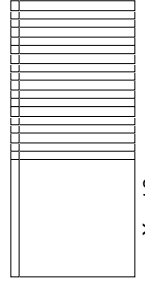
12) $\frac{X + 3}{X + 1} \times \frac{X + 3}{X^2 + 3X}$



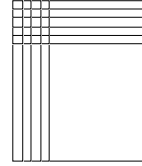
13) $\frac{X + 8}{X + 1} \times \frac{X + 8}{X^2 + 8X}$



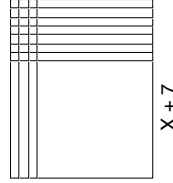
14) $\frac{X + 18}{X + 1} \times \frac{X + 18}{X^2 + 18X}$



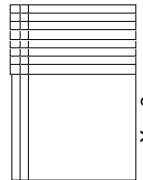
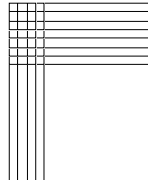
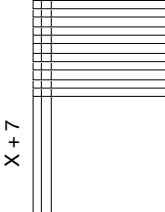
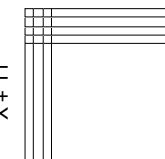
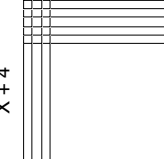
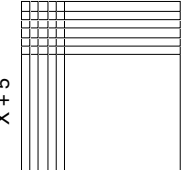

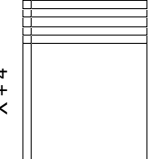
15) $\frac{X + 5}{X + 4} \times \frac{4X + 20}{X^2 + 5X}$

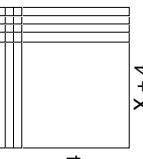
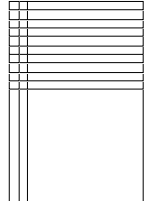
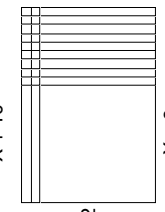
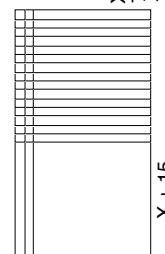
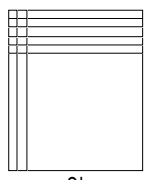
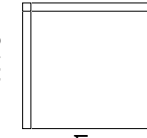
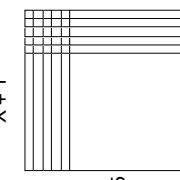
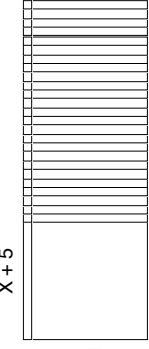


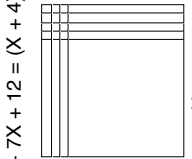
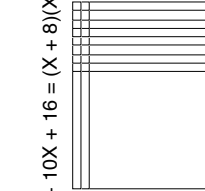
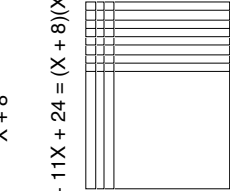
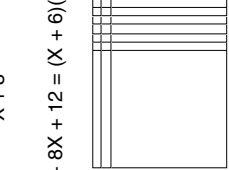
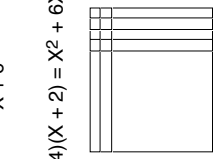
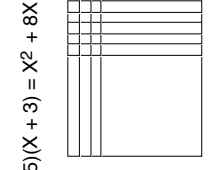
16) $\frac{X + 7}{X + 3} \times \frac{3X + 21}{X^2 + 7X}$



20B

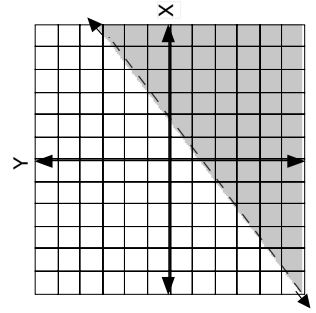
- 1)
$$\begin{array}{r} X+8 \\ x \\ \hline 2X+16 \\ X^2+8X \\ \hline X^2+10X+16 \end{array}$$
  $X+8$
- 2)
$$\begin{array}{r} X+7 \\ x \\ \hline 4X+28 \\ X^2+7X \\ \hline X^2+11X+28 \end{array}$$
  $X+7$
- 3)
$$\begin{array}{r} X+11 \\ x \\ \hline 2X+22 \\ X^2+11X \\ \hline X^2+13X+22 \end{array}$$
  $X+11$
- 4)
$$\begin{array}{r} X+4 \\ x \\ \hline 3X+12 \\ X^2+4X \\ \hline X^2+7X+12 \end{array}$$
  $X+4$
- 5)
$$\begin{array}{r} X+5 \\ x \\ \hline 3X+15 \\ X^2+5X \\ \hline X^2+8X+15 \end{array}$$
  $X+5$
- 6)
$$\begin{array}{r} X+6 \\ x \\ \hline 5X+30 \\ X^2+6X \\ \hline X^2+11X+30 \end{array}$$
  $X+6$
- 7)
$$\begin{array}{r} X+4 \\ x \\ \hline X+4 \\ X^2+4X \\ \hline X^2+5X+4 \end{array}$$
  $X+4$
- 8)
$$\begin{array}{r} X+5 \\ x \\ \hline X+5 \\ X^2+5X \\ \hline X^2+6X+5 \end{array}$$
  $X+5$

- 9)
$$\begin{array}{r} X+4 \\ x \\ \hline 4X+16 \\ X^2+4X \\ \hline X^2+8X+16 \end{array}$$
  $X+4$
- 10)
$$\begin{array}{r} X+10 \\ x \\ \hline 2X+20 \\ X^2+10X \\ \hline X^2+12X+20 \end{array}$$
  $X+10$
- 11)
$$\begin{array}{r} X+9 \\ x \\ \hline 2X+18 \\ X^2+9X \\ \hline X^2+11X+18 \end{array}$$
  $X+9$
- 12)
$$\begin{array}{r} X+15 \\ x \\ \hline 2X+30 \\ X^2+15X \\ \hline X^2+17X+30 \end{array}$$
  $X+15$
- 13)
$$\begin{array}{r} X+5 \\ x \\ \hline 2X+10 \\ X^2+5X \\ \hline X^2+7X+10 \end{array}$$
  $X+5$
- 14)
$$\begin{array}{r} X+1 \\ x \\ \hline X+1 \\ X^2+X \\ \hline X^2+2X+1 \end{array}$$
  $X+1$
- 15)
$$\begin{array}{r} X+5 \\ x \\ \hline 5X+25 \\ X^2+5X \\ \hline X^2+10X+25 \end{array}$$
  $X+5$
- 16)
$$\begin{array}{r} X+25 \\ x \\ \hline X+25 \\ X^2+25X \\ \hline X^2+50X+25 \end{array}$$
  $X+25$

- 1) $X^2 + 7X + 12 = (X + 4)(X + 3)$
 $X+4$
- 2) $X^2 + 10X + 16 = (X + 8)(X + 2)$
 $X+8$
- 3) $X^2 + 11X + 24 = (X + 8)(X + 3)$
 $X+8$
- 4) $X^2 + 8X + 12 = (X + 6)(X + 2)$
 $X+6$
- 5) $(X + 4)(X + 2) = X^2 + 6X + 8$
 $X+4$
- 6) $(X + 5)(X + 3) = X^2 + 8X + 15$
 $X+5$

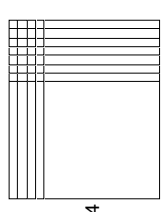
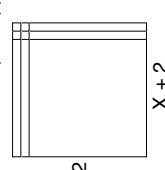
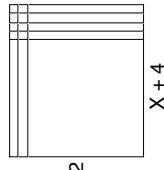
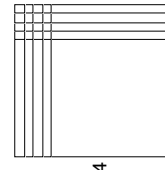
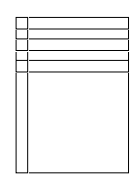
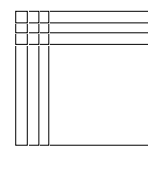
20C

- 7) $X^2 + 7X + 6 = (X + 6)(X + 1)$
- 8)
$$\begin{array}{r} X+6 \\ x \\ \hline X+6 \\ X^2+6X \\ \hline X^2+7X+6 \end{array}$$
- 9) $X^2 + 2X + 1 = (X + 1)(X + 1)$
- 10)
$$\begin{array}{r} X+1 \\ x \\ \hline X+1 \\ X^2+X \\ \hline X^2+2X+1 \end{array}$$
- 11)
$$\begin{array}{r} 2X^2 - 7X - 3 \\ X^2 + 5X + 9 \\ \hline 3X^2 - 2X + 6 \end{array}$$
- 12)
$$\begin{array}{r} 6X^2 + 2X + 1 \\ X^2 - 4X + 3 \\ \hline 7X^2 - 2X + 4 \end{array}$$
- 13) $P^8P^4 = P^{12}$
- 14) $R^{(-2)(-3)}S^{(3)(-3)} = R^6S^{-9}$
- 15) 225
- 16) $\neq 4$
- 17)
$$\begin{array}{l} 11N + 2(N + 2) = 6(N + 4) + 1 \\ 11N + 2N + 4 = 6N + 25 \\ 7N = 25 - 4 \\ N = 3 \end{array}$$
 3, 5, 7
- 18) $.10T + .05F = .60, \quad T + F = 9$
 $10T + 5F = 60$
 $-5T - 5F = -45$
 $5T = 15$
 $T = 3$
 $(3) + F = 9$
 $F = 6$
- 19) $7X - Y = -3$

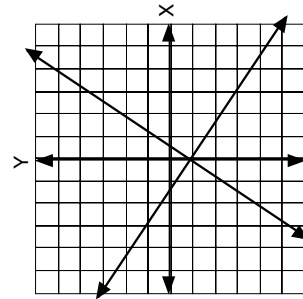


20) $Y < 3/4 X - 5/4$

20D

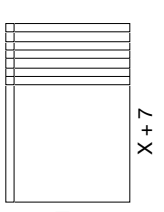
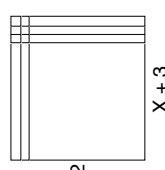
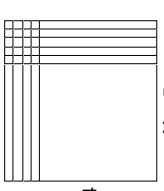
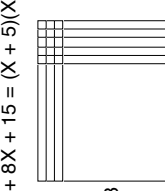
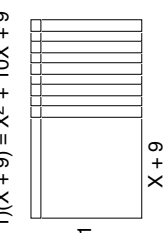
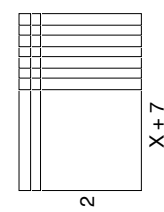
- 1) $X^2 + 11X + 28 = (X + 7)(X + 4)$

- 2) $X^2 + 4X + 4 = (X + 2)(X + 2)$

- 3) $X^2 + 6X + 8 = (X + 4)(X + 2)$

- 4) $X^2 + 8X + 16 = (X + 4)(X + 4)$

- 5) $(X + 5)(X + 1) = X^2 + 6X + 5$

- 6) $(X + 3)(X + 3) = X^2 + 6X + 9$


- 7) $X^2 + 12X + 32 = (X + 8)(X + 4)$
- 8) $\frac{X+8}{X+4} \cdot \frac{4X+32}{X^2+8X} = \frac{X^2+12X+32}{X^2+12X+32}$
- 9) $X^2 + 20X + 100 = (X + 10)(X + 10)$
- 10) $\frac{X+10}{X+10} \cdot \frac{10X+100}{X^2+20X+100} = \frac{10X+100}{X^2+20X+100}$
- 11) $\frac{X^2 + X - 4}{X^2 + 3X + 3} = \frac{2X^2 + 4X - 1}{2X^2 + 4X - 1}$
- 12) $\frac{2X^2 + 7X + 6}{5X^2 - 4X + 10} = \frac{7X^2 + 3X + 16}{7X^2 + 3X + 16}$
- 13) $P(5)(3)(-2) = P-30$
- 14) anything to the "0" power equals 1
- 15) 121
- 16) ± 12
- 17) $\frac{14(N+2) + 4N = 12(N+4) - 2}{18N + 28 = 12N + 46}$
 $6N = 18$
 $N = 3$ 3, 5, 7
- 18) $.10T + .05F = 1.80, \quad T + F = 27$
 $10T + 5F = 180$
 $-5T - 5F = -135$
 $5T = 45$
 $T = 9$
 $(9) + F = 27$
 $F = 18$

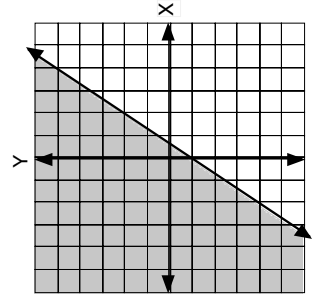


- 19) on the graph
- 20) $m = -2/3$
 $(-3) = -2/3(3) + b$
 $b = -1$

20E

- 1) $X^2 + 8X + 7 = (X + 7)(X + 1)$

- 2) $X^2 + 5X + 6 = (X + 3)(X + 2)$

- 3) $X^2 + 9X + 20 = (X + 5)(X + 4)$

- 4) $X^2 + 8X + 15 = (X + 5)(X + 3)$

- 5) $(X + 1)(X + 9) = X^2 + 10X + 9$

- 6) $(X + 7)(X + 2) = X^2 + 9X + 14$


- 7) $X^2 + 7X + 12 = (X + 3)(X + 4)$
- 8) $\frac{X+3}{X+4} \cdot \frac{4X+12}{X^2+3X} = \frac{X^2+7X+12}{X^2+7X+12}$
- 9) $X^2 + 10X + 21 = (X + 3)(X + 7)$
- 10) $\frac{X+3}{X+7} \cdot \frac{7X+21}{X^2+3X} = \frac{X^2+10X+21}{X^2+10X+21}$
- 11) $\frac{4X^2 - 4X + 1}{X^2 + 2X - 1} = \frac{5X^2 - 2X + 0}{5X^2 - 2X + 0}$
- 12) $\frac{2X^2 + 3X + 3}{X^2 + 7X - 2} = \frac{3X^2 + 10X + 1}{3X^2 + 10X + 1}$
- 13) $P^{0+4-1} = P^3$
- 14) $S(2)(-2)R^5 = S^4R^5$ (R^0 and $S^0 = 1$)
- 15) 169
- 16) ± 5
- 17) $\frac{N+1 + 7(N+2) = 5N}{N+1 + 7N + 14 = 5N}$
 $8N + 15 = 5N$
 $N = -5$ -5, -4, -3
- 18) $.01P + .05F = .76, \quad P + F = 20$
 $P + 5F = 76$
 $-P - F = -20$
 $\frac{4F = 56}{F = 14}$
 $P + (14) = 20$
 $P = 6$
- 19) $Y = -3/4 X + 4$



- 20) $Y \geq 3/2 X - 1$

Test 20

- 1) E $\frac{X + A}{x} \cdot \frac{X + B}{X + AB} = \frac{X^2 + (A + B)X + AB}{X^2 + AX}$
- 2) B
- 3) B
- 4) E
- 5) B
- 6) B
- 7) C
- 8) D
- 9) A
- 10) B
- 11) D $\frac{A + B}{x} \cdot \frac{A + B}{A^2 + AB} = \frac{A^2 + 2AB + B^2}{A^2 + 2AB + B^2}$
- 12) E $\frac{X + BY}{x} \cdot \frac{X + BY}{BYX + (BY)^2} = \frac{X^2 + 2BYX + (BY)^2}{X^2 + 2BYX + (BY)^2}$
- 13) C
- 14) B
- 15) B

Test 19

- 1) A
- 2) D $\frac{4X + 3}{4X^2 + 3X} \cdot \frac{4X + 3}{4X^2 + 7X + 3}$
- 3) A
- 4) E
- 5) E
- 6) C
- 7) B
- 8) C $\frac{4X + 3}{x} \cdot \frac{X + 1}{4X + 3} = \frac{X + 1}{x}$
- 9) B $\frac{X + 3}{x} \cdot \frac{X + 2}{2X + 6} = \frac{X + 3}{x} \cdot \frac{X + 2}{2(X + 3)} = \frac{X + 2}{2x}$
- 10) A $\frac{X + 4}{x} \cdot \frac{X - 2}{-2X - 8} = \frac{X + 4}{x} \cdot \frac{X - 2}{-2(X + 4)} = \frac{X - 2}{-2x}$
- 11) C $\frac{X + 1}{x} \cdot \frac{X + 5}{5X + 5} = \frac{X + 1}{x} \cdot \frac{X + 5}{5(X + 1)} = \frac{X + 5}{5x}$
- 12) D $\frac{X - 3}{x} \cdot \frac{X - 6}{-6X + 18} = \frac{X - 3}{x} \cdot \frac{X - 6}{-6(X - 3)} = \frac{X - 6}{-6x}$
- 13) B
- 14) B
- 15) B

Test 18

- 1) C
- 2) D $X^{-3+(4)} = X^{-7}$
- 3) E
- 4) E
- 5) A $8^{2+(-2)} = 8^{-4}$
- 6) C $7^{-5-3} = 7^{-8}$
- 7) E $X^{6-2} = X^4$
- 8) A
- 9) B any number to the zero power is 1
- 10) E $X^{-2-3}Y^{6+1} = X^{-5}Y^7$
- 11) B $A^{-1-8}B^{7+2} = A^{-9}B^9$
- 12) E $B^{4+2+3} = B^9$
- 13) A $P^{3-4}N^{-2+2} = P^{-1}N^4$
- 14) D $9^{2.5} = 9^{10}$
- 15) C $X^A \cdot B = X^{AB}$

Test 17

- 1) E $(-6 \cdot -6) = 36$
- 2) D $-(6 \cdot 6) = -36$
- 3) A $R^{2+4} = R^6$
- 4) B $R^{4-2} = R^2$
- 5) E $R^{8-2} = R^6$
- 6) B $A^{5X+3X} = A^{8X}$
- 7) C $C^{4+3}D^{2+1} = C^7D^3$
- 8) C
- 9) A $48-2 = 46$
- 10) C $X^{2+4}Y^{3+1} = X^6Y^4$
- 11) B
- 12) C
- 13) C
- 14) B
- 15) A

An exponential equation for growth can be written as follows: $B = A \cdot 2^{\frac{x}{d}}$

B = the number of bacteria d = doubling time
A = the beginning population x = elapsed time

Be sure that you use the same units of time for x and d. You might want to check this formula with the problems on bacterial growth in Lesson 18 and see if you get the same results as on the charts you filled in.

Use the growth equation to answer the questions. The first one is done for you.

- 1) If ten bacteria cells double every five minutes, how many bacteria will there be in ten minutes?

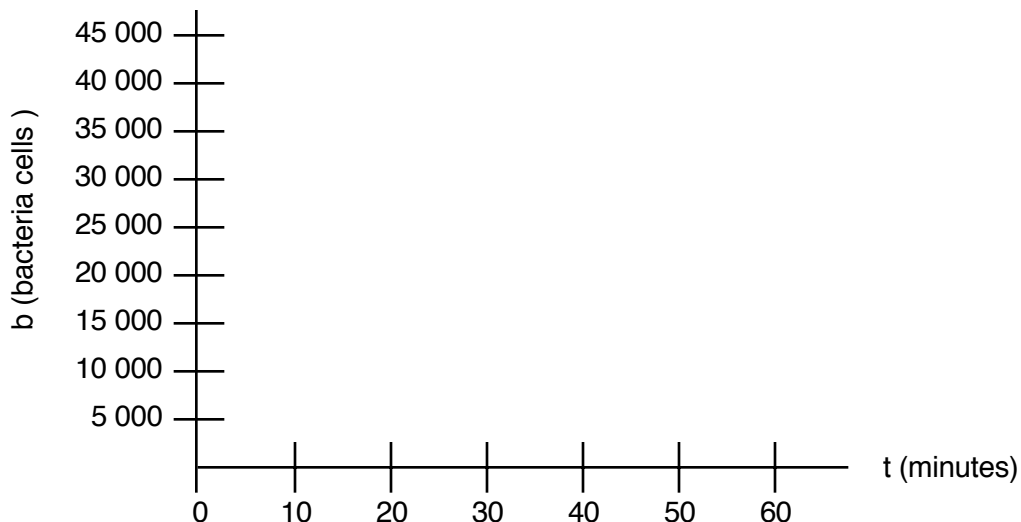
$$A = 10, d = 5 \text{ minutes, and } x = 10 \text{ minutes, so } B = 10 \cdot 2^{\frac{10}{5}} \rightarrow B = 10 \cdot 2^2 \rightarrow B = 10 \cdot 4 = 40$$

After 10 minutes, there will be 40 bacteria cells.

- 2) If ten bacteria cells double every five minutes, how many bacteria will there be in 30 minutes?

- 3) If ten bacteria cells double every five minutes, how many bacteria will there be in one hour?

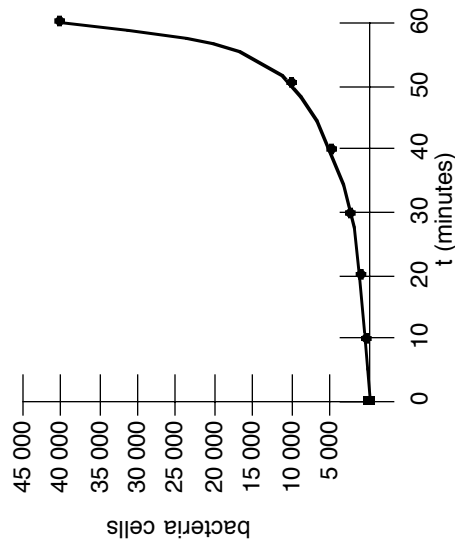
- 4) Make a graph showing the first hour of bacterial growth described above.



Lesson 20

- 1) done
- 2) $B = (A)^x 2^{\frac{30}{25}}$
 $B = 10 (2^6) = 640$
- 3) $B = 10 (2^{\frac{60}{25}})$
 $B = 10 (2^{12}) = 40960$

4)



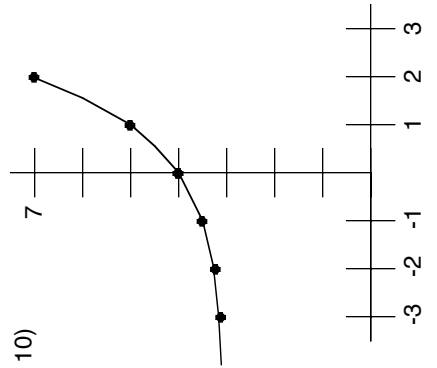
Lesson 21

- 1) never true: $3^{-2} = \frac{1}{9}$
- 2) sometimes true: $(\frac{1}{3})^{-2} = 9$
- 3) never true: $\frac{1}{7} \neq \frac{1}{2} + \frac{1}{5}$
- 4) never true: $\frac{2}{X^0} = \frac{2}{1} = 2$
- 5) always true: $1 - 1 = 0$
- 6) never true: $8^{-1} = \frac{1}{8}$
- 7) always true: a number multiplied by its reciprocal always equals 1
- 8) always true: when raising a power to a power, you multiply exponents

9)

X	Y
0	4
1	5
2	7
-1	3.5
-2	3.25

10)

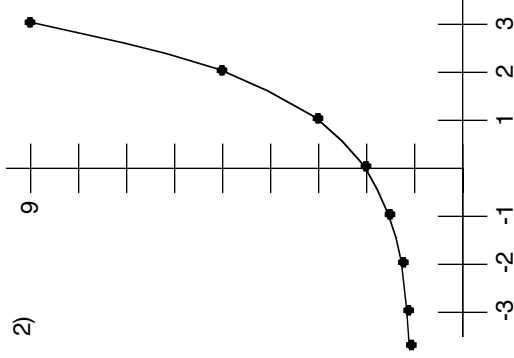


Lesson 22

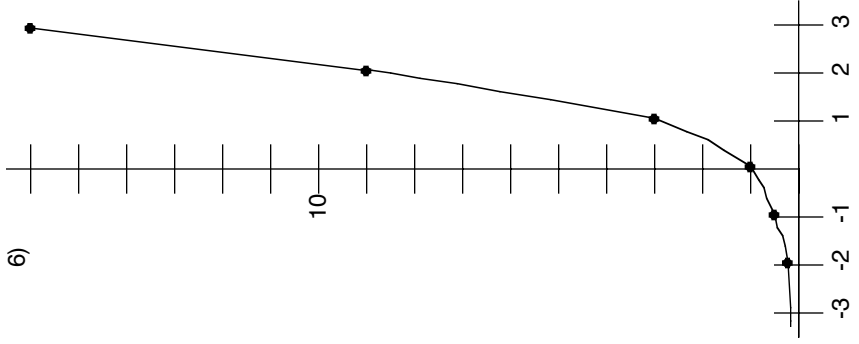
1)

X	Y
0	2
1	3
2	5
3	9
-1	1.5
-2	1.25
-3	1.125

2)



6)



- 3) They get smaller.
- 4) They get larger.