Name ________________________ Period ______ Date ____________

Algebra I Unit 3 Model Curriculum Assessment

1. Solve the equation $2x - 3 = \frac{x^2}{3}$ for x. Show your work and give your answer in simplest form.

2. Which of the following is a solution to the equation $0 = x^2 + 6x + 4$?

a. $x = -3 - \sqrt{5}$

b. $x = -3 - 2\sqrt{5}$

c. $x = -6 + \sqrt{5}$

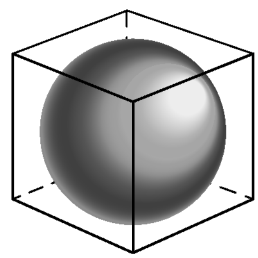
d. $x = -6 + 2\sqrt{5}$

3. Solve the equation $(t-7)^2+18=9$ for t. Show your work.

4. What are the solutions of the equation $3x^2+13x=10$? Show your work.

5. Write an expression for the area of a square with sides of length $a + b$. Use the distributive property to fully expand the expression. Show your work.

6.



The figure above shows a sphere inscribed inside a cube. The volume of the cube outside the sphere can be found using the following formula.

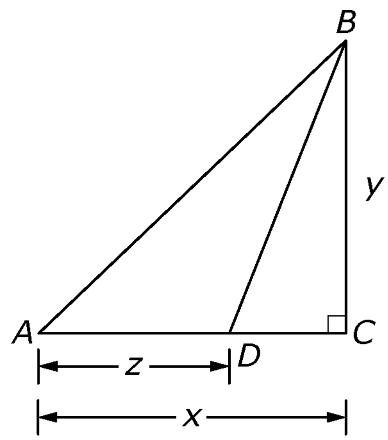
$$V = (x \cdot x \cdot x) - \frac{4}{3}\pi\left(\frac{1}{2}x\right)^3$$

Part A: What does $(x \cdot x \cdot x)$ in the formula represent?

Part B: How does $\left(\frac{1}{2}x\right)$ in the formula relate to the sphere?

Part C: Rewrite the given formula as an equation of the form $V = ax^n$, where a and n are constants. Show your work.

7.



The area of triangle *ABD* above can be found using the formula

$$\text{Area} = \frac{xy}{2} - \frac{(x - z)y}{2}$$

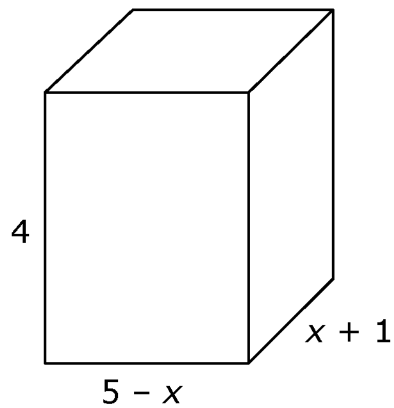
Explain how the formula was derived, then simplify the formula.

8. A city's population, *P*, in thousands, can be modeled by the equation $P = 325(1.04)^t$, where t is the number of years since the year 2000.

Part A: In the given equation, what does the number 325 represent?

Part B: In the given equation, what does the number 1.04 represent?

9. The volume of the rectangular prism shown below can be modeled by the function $V(t) = 4(5 - x)(x + 1)$.



Rewrite the function in an equivalent form that highlights the maximum possible volume of the prism. Circle the part of the rewritten function that gives the maximum volume.

10. A ball is thrown in the air from a platform that is 48 feet above the ground with an initial vertical velocity of 32 feet per second. The height of the ball, in feet, can be represented by the function $h(t) = -16t^2 + 32t + 48$, where t is the time, in seconds, since the ball was thrown. Which of the following shows the function rewritten in the form that would be best to use to identify the maximum height of the ball?

a. $h(t) = -16(t-2)^2 + 112$

b. $h(t) = -16(t-2)^2 + 96$

c. $h(t) = -16(t-1)^2 + 80$

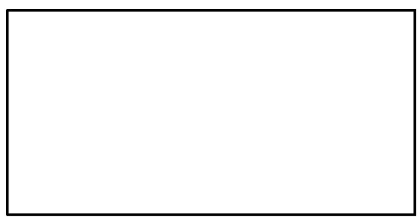
d. $h(t) = -16(t-1)^2 + 64$

11. In an experiment, a colony of bacteria is growing at a rate of 20% per hour. The function $f(t) = P * 1.2^t$ represents the population of bacteria t hours after the start of the experiment, where P is the initial population at the start of experiment. The researcher wants to determine the growth rate per minute instead of per hour. If the function is rewritten in the form $f(t) = P * a^{60t}$, what is the value of a ?

12. Simplify the expression below.

$$\left(12s^4 - 6s^2 + 4s\right) + \left(6s^4 - 4s + 27\right) - \left(4s^4 + s^2 + 12\right)$$

13.



$(2 - 3x)$

$(2x + 5)\ (x - 1)$

Part A: Create an expression that represents the perimeter of the rectangle above. Write the expression as a polynomial in standard form. Show your work.

Part B: Create an expression that represents the area of the rectangle above. Write the expression as a polynomial in standard form. Show your work.

14. An error has been made in subtracting the two polynomials shown in the work below.

$$(6x^2 - 4x - 5) - (3x^2 - 7x + 2) =$$

$$\begin{array}{r} 6x^2 - 4x - 5 \\ \underline{-3x^2 - 7x + 2} \\ 3x^2 - 11x - 3 \end{array}$$

Part A: Explain the error that has been made.

Part B: Show how to correctly subtract the two polynomials.

15. The table below identifies the values for the first 5 terms in an arithmetic sequence.

Term Number, n	1	2	3	4	5
Term Value, a_n	$5\frac{1}{2}$	6	$6\frac{1}{2}$	7	$7\frac{1}{2}$

Part A: Write an equation that can be used to find the value of a_n, the nth term in the sequence.

Part B: By how much does the term value change with each term number increase of 1 ?

16. The half-life of a radioactive substance is the time it takes for a quantity of the substance to decay to half of the initial amount. The half-life of the radioactive gas radon is approximately 3.8 days. The initial amount of radon used in an experiment is 75 grams. If N represents the number of grams of radon remaining t days after the start of the experiment, write an equation that gives N in terms of t.

17. Bryant's pool contains 13,000 gallons of water. The maximum rate at which the city allows pools to be drained is 720 gallons per hour. Write a function that represents the number of gallons of water left in Bryant's pool t hours after he starts draining, if he drains the pool at the maximum rate.

18. The student council is selling cupcakes at the school play. The cost to make the cupcakes is a fixed $75 plus $0.17 per cupcake made. Each cupcake sells for $2.00.

Part A: Write an equation for the cost, C, of making x cupcakes and an equation for the revenue, R, from selling x cupcakes.

Part B: Write an inequality that could be solved to find the number of cupcakes that the student council must make and sell to make a profit.

Part C: Solve the inequality, and determine how many cupcakes must be sold to make a profit.

19. A computer store offers customers a protection plan when they buy a computer. When the plan is priced at $50, the store can sell 100 plans every month for a total of $5,000. A research company determines that for every $5 increase in the price of the plan, the store will sell 3 fewer plans per month.

Part A: Write an expression for the price, in dollars, of a plan if the manager implements x $5 price increases.

Part B: Write an expression for the number of plans the store will sell if the manager implements x $5 price increases.

Part C: Write an expression for the total, in dollars, the store will receive from the sale of protection plans if the manager implements x $5 price increases. Write the expression in standard form.

Part D: Write an inequality that can be used to find x, the number of $5 price increases that the manager should implement to receive a total of at least $7,000 per month from the sale of protection plans.

20. In a classroom, there are 3 more girls than boys and the ratio of girls to boys is 6 to 5.

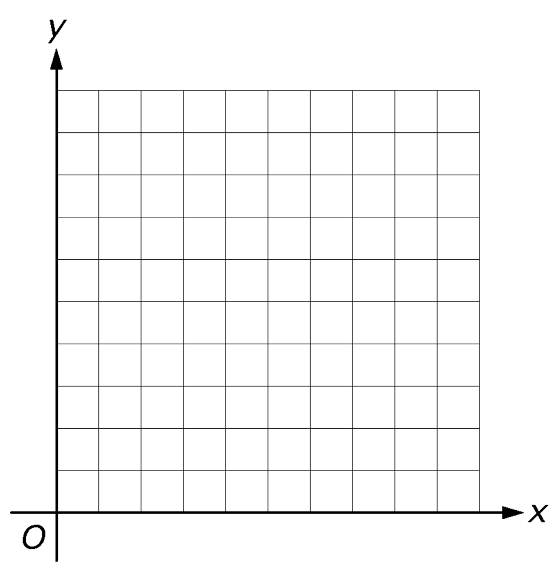
Part A: Write an equation in one variable that represents the situation described above, where g represents the number of girls in the classroom.

Part B: What is the total number of students in the classroom?

21. A rectangle has length x and width y. The perimeter of the rectangle is 32.

Part A: Write an equation that represents the relationship between x and y described above.

Part B: Graph the equation on the coordinate grid below. Provide a scale for each axis.



22.

x	y
–2	9
–1	3
0	1
1	3
2	9

Which of the following equations could represent the relationship between x and y shown in the table above?

a. $y = -(5x + 1)$

b. $y = -4x + 1$

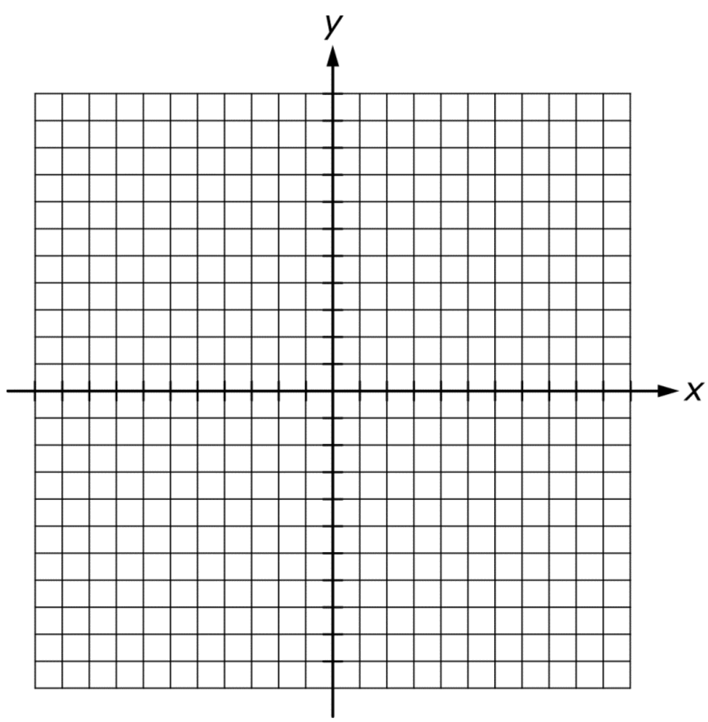
c. $y = 2x^2 + 1$

d. $y = (2x + 1)^2$

23. A parabola has its vertex at $(2, -3)$ and its y-intercept at 5.

Part A: Write an equation of the parabola in the form $y = a(x-h)^2 + k$.

Part B: Graph the parabola on the coordinate grid below. Be sure to provide an appropriate scale on the axes.



24. The incomplete work below shows how the technique of completing the square can be used to solve the equation $ax^2 + bx + c = 0$, where a, b, and c are constants and $a \neq 0$. Fill in the missing pieces in the work, then explain when the roots of the equation will be real or complex.

$$\frac{ax^2}{a} + \frac{bx}{a} + \frac{c}{a} = \frac{0}{a}$$

$$x^2 + \frac{bx}{a} + \frac{c}{a} = 0$$

$$x^2 + \frac{bx}{a} = -\frac{c}{a}$$

$$x^2 + \frac{bx}{a} + \frac{b^2}{4a^2} = -\frac{c}{a} + \boxed{}$$

$$x^2 + \frac{bx}{a} + \frac{b^2}{4a^2} = \frac{-4ac + b^2}{4a^2}$$

$$\left(\boxed{}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

$$\sqrt{\left(\boxed{}\right)^2} = \pm\sqrt{\frac{b^2 - 4ac}{4a^2}}$$

$$\boxed{} = \pm\frac{\sqrt{b^2 - 4ac}}{\boxed{}}$$

$$x = \boxed{}$$

25. How many real solutions, if any, does $2x^2 - 3x + 8 = 0$ have? Explain how you know.

26. If the equation $2x^2 + bx + 5 = 0$ has no real solutions, which of the following must be true?

a. $b^2 < 10$

b. $b^2 > 10$

c. $b^2 < 40$

d. $b^2 > 40$

27. If $ax^2 - 6x + 3 = 0$ has no real solutions, and a is an integer, what is the least possible value of a ?