Algebra 8 Quarter 2 Cumulative Test

What to Know …

Growing, Growing, Growing

- Create a table and a graph of an exponential growth or decay relationship given a description or equation
- Write an exponential growth or decay equation given a graph, table, or two points
- Write expressions in exponential, expanded, and standard form
- Write numbers in scientific notation and standard form
- Perform operations with scientific notation
- Write an exponential equation with a y-intercept other than 1
- Identify whether a table is linear, exponential, or neither based on a table, graph or equation
- Write the equation of a linear or exponential relationship given a table, graph, or equation
- Estimate when an exponential relationship will reach a certain number
- Calculate a growth or decay factor from a table, graph, or two points
- Calculate a growth or decay factor given a rate
- Calculate a growth or decay rate given a factor
- Simplify monomial expressions either by expanding or using the laws of exponents

Data Analysis

- Calculate unit prices
- Calculate averages and understand how an individual measurement effects the calculated average.
- Create a bar graph given data
- Create a circle graph given data
- Calculate the number of degrees of the central angle of a circle graph given data.

Practice Problems

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

1. Write an equation for the line passing through the points (-2, 3) and (1, -3).

$m = \frac{-3-3}{1-(-2)} = \frac{-6}{3} = -2$

$-3 = -2(1) + b$

$-3 = -2 + b$

$+2 \quad +2$

$-1 = b$

$y = -2x - 1$

2. Write an equation for the line passing through the points (17 , 8) and (17 , -2).

$m = \frac{-2-8}{17-17} = \frac{-10}{0}$ Undefined.

$x = 17$

3. Write an equation for the line passing through the points (-3, 5) and (-7 , 8).

$m = \frac{8-5}{-7-(-3)} = \frac{3}{-4}$

$5 = -\frac{3}{4}(-3) + b$

$\frac{20}{4} \leftarrow 5 = \frac{9}{4} + b$

$-\frac{9}{4} \quad -\frac{9}{4}$

$\frac{11}{4} = b$

$y = -\frac{3}{4}x + \frac{11}{4}$

4. Find the equation of the line that has a slope of m=4 and passes through the point (-1, -6).

$-6 = 4(-1) + b$

$-6 = -4 + b$

$+4 \quad +4$

$-2 = b$

$y = 4x - 2$

5. Find the equation of the line that passes through the points (-2,4) and (1,2).

$m = \frac{2-4}{1-(-2)} = \frac{-2}{3}$

$2 = -\frac{2}{3}(1) + b$

$\frac{6}{3} \leftarrow 2 = -\frac{2}{3} + b$

$+\frac{2}{3} \quad +\frac{2}{3}$

$\frac{8}{3} = b$

$y = -\frac{2}{3}x + \frac{8}{3}$

6. Find an equation of the line that passes through the points (4, 5) and (7, -1).

$m = \frac{-1-5}{7-4} = \frac{-6}{3} = -2$

$5 = -2(4) + b$

$5 = -8 + b$

$+8 \quad +8$

$13 = b$

$y = -2x + 13$

7. Write an equation for the line that passes through the points (2, 7) and (6, 15).

$m = \frac{15-7}{6-2} = \frac{8}{4} = 2$

$7 = 2(2) + b$

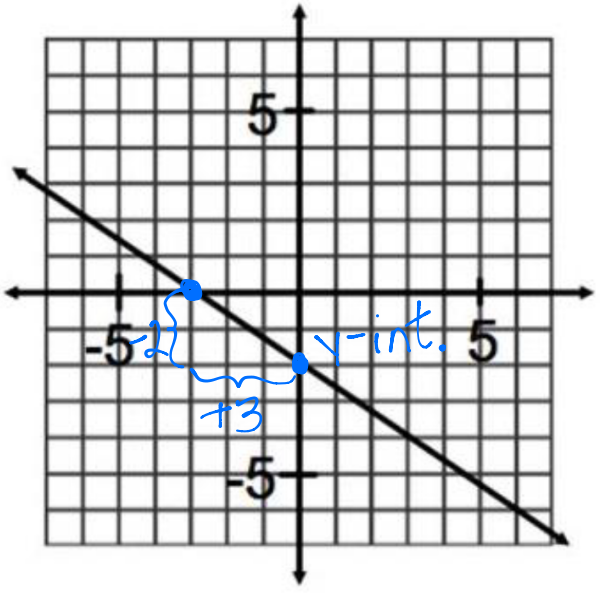
$7 = 4 + b$

$-4 \quad -4$

$3 = b$

$y = 2x + 3$

8. Write the equation of the line below.



$\frac{\Delta y}{\Delta x} = \frac{-2}{3}$

$y = -\frac{2}{3}x - 2$

Given the following equations, solve for x:

10. $\frac{2}{3}x - 5 = 3x + 7$ ← Could also multiply by 3 here

$+5 \quad +5$

$\frac{2}{3}x = 3x + 12$

$-3x \quad -3x$

$-\frac{7}{3}x = 12$

$-\frac{7}{3} \quad -\frac{7}{3}$

$x = -\frac{36}{7}$

$\frac{12}{1} \div -\frac{7}{3}$

$\frac{12}{1} \cdot \frac{3}{-7} = \frac{36}{-7}$

11. $6x - 1(3x + 8) = 16$

$6x - 3x - 8 = 16$

$3x - 8 = 16$

$+8 \quad +8$

$\frac{3x}{3} = \frac{24}{3}$

$x = 8$

12. $5x + 2(x + 4) = 64$

$5x + 2x + 8 = 64$

$7x + 8 = 64$

$-8 \quad -8$

$\frac{7x}{7} = \frac{56}{7}$

$x = 8$

13. $13 - 1(2x + 2) = 2(x + 2) + 3x$

$13 - 2x - 2 = 2x + 4 + 3x$

$11 - 2x = 5x + 4$

$-4 \quad -4$

$7 - 2x = 5x$

$+2x \quad +2x$

$\frac{7}{7} = \frac{7x}{7}$

$x = 7$

15. $3(2x - 5) + 4 = 5 - 2x$

$6x - 15 + 4 = 5 - 2x$

$6x - 11 = 5 - 2x$

$+11 \quad +11$

$6x = 16 - 2x$

$+2x \quad +2x$

$\frac{8x}{8} = \frac{16}{8}$

$x = 2$

16. $4x - 5 - 2x = 3 - 10 + 3x$

$2x - 5 = -7 + 3x$

$+5 \quad +5$

$2x = -2 + 3x$

$-3x \quad -3x$

$\frac{-x}{-1} = \frac{-2}{-1}$

$x = 2$

17. $10 - \frac{1}{2}x = 4 + \frac{1}{3}x + 1$

$+\frac{1}{2}x \quad +\frac{1}{2}x$

$10 = \frac{5}{6}x + 5$

$-5 \quad -5$

$\frac{5}{\frac{5}{2}} = \frac{\frac{5}{6}x}{\frac{5}{2}}$

$\frac{5}{1} \div \frac{5}{6} \Rightarrow \frac{5}{1} \cdot \frac{6}{5} = 6$

$x = 6$

18. $\frac{x}{-2} + 5 = 3$

$-5 \quad -5$

$-\frac{2}{1} \cdot \left(\frac{x}{-2}\right) = (-2) \cdot -\frac{2}{1}$

$x = 4$

31. Garden City introduced a recycling program. The goal of the program is to reduce the number of pounds of trash sent to landfills by 25% each year. In 2000, Garden City produced 100,000 tons of trash. If the recycling program were to reach its goal, how many tons of trash can Garden City expect to produce in the year 2020?

Decay rate!

y-intercept!

y = years since 2000

t = tons of trash produced

$t = 100000(.75)^y \rightarrow t = 100000(.75)^{20}$

$= 317.12$ tons of trash

32. Jasmine wins $5000 on a scratch ticket and invests it at a rate of 3.5% compounded annually. How much money will she have after 15 years?

y-intercept!

Growth rate!

y = # of years

m = money

$m = 5000(1.035)^y \rightarrow m = 5000(1.035)^{15}$

$= \$8376.74$

33. At a national park, the decay factor for the bear population is 0.87 each year. The decay rate for the fox population is 17% per year. Which population has the greatest percent of their population remaining each year?

Bear: DF = .87. Keeping 87%.

Fox: DR = 17%, so DF = .83. Keeping 83%.

The bear population.

34. Given the equation $y = 250(.65)^x$, what is the decay rate?

Keeping 65%.

100% - 65% = 35%

35. Fill in the missing values in the table for this exponential relationship

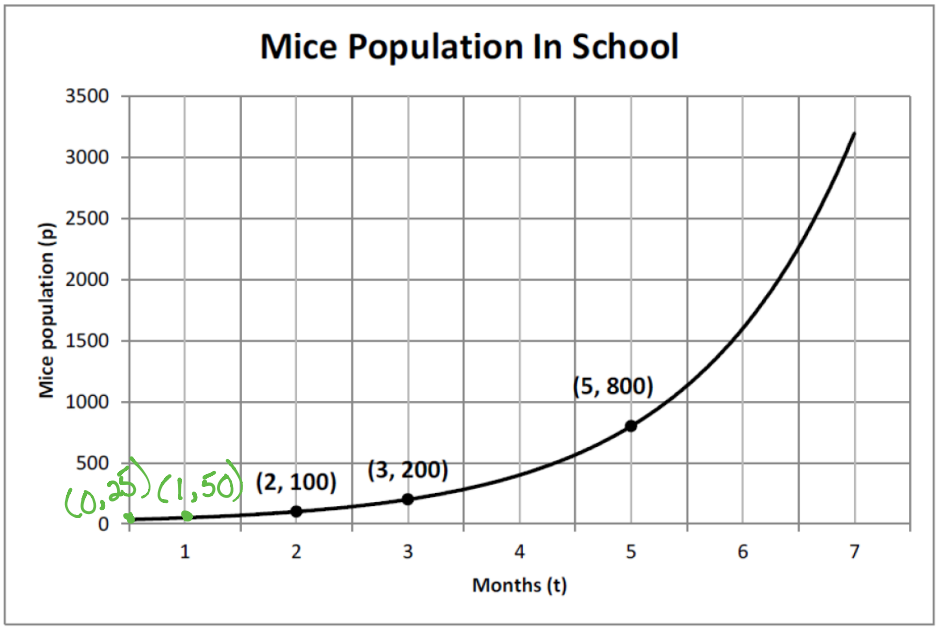
# of Hours	# of Bacteria
2	176
3	704
4	2816
5	11264
6	45056

What is the equation?

$y = 11(4)^x$

$\frac{11264}{2816} = 4$

36.



Write an exponential equation that models the number of mice (p) for a given number of months (t).

$\frac{200}{100} = 2$ $\quad p = 25(2)^t$

37. A population of bugs has a growth factor of 4. After year 2, there are 480 bugs. After year 3, there are 1,920 bugs. Write the equation that models the population growth.

year	bugs	
0	30	÷4
1	120	÷4
2	480	
3	1920	

$\frac{1920}{480} = 4$

$y = 30(4)^x$

38. Which of the following is growing at the fastest rate: a growth factor of 2.3, a growth rate of 230%, the equation $y = 30(1.99)^x$, or a growth rate of 199%? Explain.

GF: 2.3

GR: 230% → GF of 3.3

$y = 30(1.99)^x$ → GF of 1.99

GR: 199% → GF of 2.99

Growth rate of 230%.

39. What is the decay factor for the following table? What is the decay rate?

x	3	4	5	6
y	190	142	107	80

$\frac{142}{190} = .75$ $\frac{107}{142} = .75$ $\frac{80}{107} = .75$

DF = .75

DR = 25%

40. A boat costs $15,500 and decreases in value by 10 percent per year. How much will the boat be worth after 5 years?

y = # of years

V = value of boat

$V = 15500(.9)^y$ → $V = 15500(.9)^5$

= $9152.60

41. The equation $y = 2(3^x)$ might represent the growth pattern for a population of mice. Complete the following sentences. Your sentence should describe the pattern in words.

i. The population started with 2 mice.

ii. The population grew at a rate of 200% percent.

iii. In 8 years, the equation predicts the population of mice to be 13122.

42. In 1995, there were 85 rabbits living in the Sprague lower field woods. The population increased by 12% each year. How many rabbits were in the Sprague woods in 2005?

y = # of years since 1995

r = # of rabbits

$r = 85(1.12)^y \rightarrow r = 85(1.12)^{10}$

$= 264$ rabbits

43. Mr. Clarke has discovered a strain of bacteria! The bacteria culture initially contained 1000 bacteria and the bacteria are doubling every half hour. Write an equation to match this situation and then determine how many bacteria are present after 3 hours? ×4 every hour

t = # of hours

b = # of bacteria

$b = 1000(4)^t \rightarrow b = 1000(4)^3$

$= 64000$ bacteria

Study the patterns in the following tables. For each table:

- Tell whether the relationship between *x* and *y* is linear, inverse, exponential, or neither.

- Explain how you know the relationship is linear, inverse, exponential, or neither.

- If the relationship is linear, inverse, exponential, write an equation for it.

44.

		-10	-8	-4
x	5	-5	-13	-17
y	-2	3	7	9
		+5	+4	+2

Linear. $\frac{\Delta y}{\Delta x} = \frac{5}{-10} = \frac{4}{-8} = \frac{2}{-4} = -\frac{1}{2}$

$-2 = -\frac{1}{2}(5) + b$

$-\frac{4}{2} \leftarrow -2 = -\frac{5}{2} + b$

$+\frac{5}{2} \quad +\frac{5}{2}$

$\frac{1}{2} = b$

$y = -\frac{1}{2}x + \frac{1}{2}$

46.

x	0	1	2	3	4
y	0	2	4	8	16

None. It would be exponential with a growth factor of 2, but there is a y-intercept of 0. 0·anything = 0.

47.

x	1	2	3	4	5
y	$\frac{1}{12}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{9}{4}$	$\frac{27}{4}$

+1 →, ×4 →

Exponential. GF = 3

$y = \frac{1}{36}(3)^x$

48.

x	0	1	2	3	4	5
y	2.3	3.8	5.3	6.8	8.3	9.8

+1 →, +1.5 →

Linear. $\frac{\Delta y}{\Delta x} = \frac{1.5}{1} = 1.5$

$y = 1.5x + 2.3$

49.

x	0	1	2	3	4	5
y	$\frac{1}{16}$	$\frac{1}{4}$	1	4	16	64

+1 →, ×4 →

Exponential. GF = 4.

$y = \frac{1}{16}(4)^x$

50.

x	y
-2	-4
-1	-1
0	2
1	5
2	8
3	11

+1 →, +3 ↓

Linear. $\frac{\Delta y}{\Delta x} = \frac{3}{1} = 3$

$y = 3x + 2$

51. ***Tennis Tournament:***

Rounds	1	2	3	4
Players left	64	32	16	8

+1 +1 +1

128

×.5 ×.5 ×.5

Exponential!

Decay Factor = 0.5

$y = 128(0.5)^x$

52.

x	-2	2	4	6
y	-7	-1	2	6

+4 +2 +2

+6 +3 +4

Not Linear $\frac{\Delta y}{\Delta x} = \frac{6}{4} = \frac{3}{2} \neq \frac{4}{2}$

No constant slope!

Not Exponential

No constant growth factor!

Simplify the following. All final answers must contain positive exponents.

53. $5b^2 \cdot 8b$

$40b^3$

54. $10xy^3 \cdot 8x^5y^3$

$80x^6y^6$

55. $(2b^2)^4$

$2b^2 \cdot 2b^2 \cdot 2b^2 \cdot 2b^2$

$16b^8$

56. $5x^3y^4 \cdot (2x^2y^4)^3$

$5x^3y^4 \cdot 8x^6y^{12}$

$40x^9y^{16}$

57. $\dfrac{14x^4y^7}{6x^5y^4}$

$\dfrac{7y^3}{3x}$

58. $\left(\dfrac{-6x^2y}{2xy^3}\right)^3$

$\left(\dfrac{-3x}{y^2}\right)^3$

$\dfrac{-27x^3}{y^6}$

59. $\dfrac{7x^2y^5}{4xy^9} \cdot \dfrac{8x^{10}y}{-2x^4y^4}$

$\dfrac{7x}{4y^4} \cdot \dfrac{-4x^6}{y^3}$

$\dfrac{-28x^7}{4y^7} = -\dfrac{7x^7}{y^7}$

60. $6a^2(-2ab^4)^3$

$6a^2 \cdot -8a^3b^{12}$

$-48a^5b^{12}$

61. $\left[\left(3x^{4y^{7z^{12}}}\right)^5\left(-5x^{9y^{3z^4}}\right)^2\right]^0$

1

62. $(3x)^{-2}$

$\dfrac{1}{(3x)^2} = \dfrac{1}{9x^2}$

Write the following numbers in proper Scientific Notation form:

63. 4,500, 200

4.5002×10^{6}

64. 0.00013

1.3×10^{-4}

65. 27×10^{3}

2.7×10^{4}

66. 43×10^{-7}

4.3×10^{-8}

Write the following numbers in Standard form:

67. 3.201×10^{2}

320.1

68. 1.17×10^{-5}

0.0000117

69. 4.785×10^{-6}

0.000004785

70. 6.03458×10^{4}

60,345.8

Simplify the following expression and express your answer in proper scientific notation form.

71. $(4.0 \times 10^{4})(1.6 \times 10^{5})$

6.4×10^{9}

72. $(2.4 \times 10^{-2})(3.0 \times 10^{-5})$

7.2×10^{-7}

73. $(4.0 \times 10^{4}) \div (2.5 \times 10^{3})$

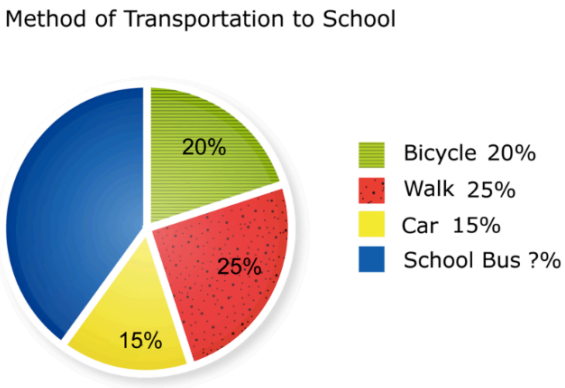
1.6×10^{1}

74. $(5.4 \times 10^{5}) \div (6.0 \times 10^{-4})$

0.9×10^{9}

9×10^{8}

75. The circle graph to the right represents the responses from 300 students at Elmwood Middle School.



What percent of the students ride the bus to school?

Bike + Walk + Car = 20% + 25% + 15%
= 60%

100% - 60% = 40%

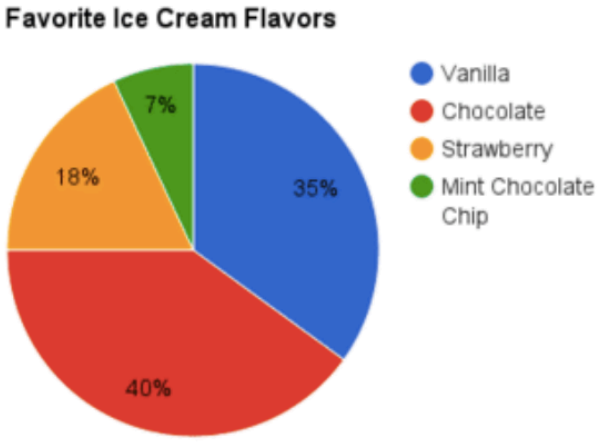
40% of students ride the bus

How many students travel by car?

300 · 0.15 = 45

45 students travel by car.

76. Calculate the number of degrees in the central angle for each flavor of ice cream represented in the graph below.



Vanilla: 0.35 · 360 = 126°

Chocolate: 0.4 · 360 = 144°

Strawberry: 0.18 · 360 = 65°

Mint Chip: 0.07 · 360 = 25°

If 350 people were surveyed, how many chose chocolate as their favorite flavor?

350 · 0.4 = 140

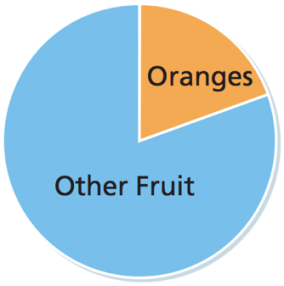
140 people chose chocolate

How many chose Strawberry?

350 · 0.18 = 63

63 people chose strawberry

76. The circle graph shows the results of a survey in which people were asked, "What is your favorite fruit?" The angle of 68° represents 277 people who said their favorite fruit is oranges.



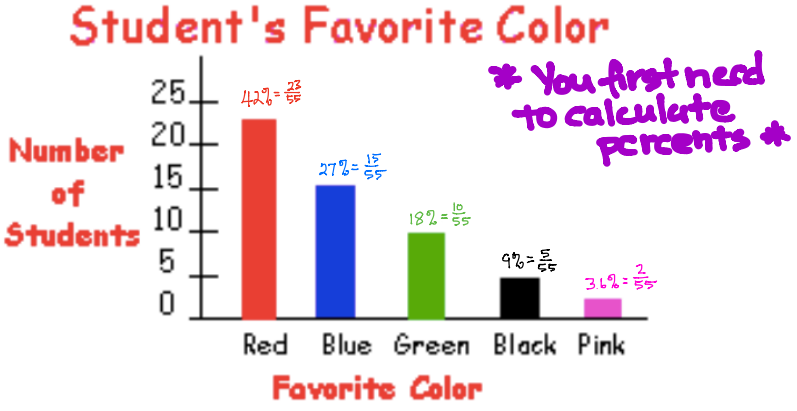
Find the approximate sample size.

$\frac{68^\circ}{360^\circ} = \frac{277}{x}$ (×4.07)

$x = 1466$

Sample size is approximately 1466 people.

77. 50 students were asked what was their favorite color. The bar graph of the data collected is below.



Calculate the number of degrees in the central angle representing each color if you were to create a circle graph.

Red: $360 \cdot 0.42 \approx 151^\circ$

Blue: $360 \cdot 0.27 \approx 97^\circ$

Green: $360 \cdot 0.18 \approx 65^\circ$

Black: $360 \cdot 0.09 \approx 32^\circ$

Pink: $360 \cdot 0.036 \approx 13^\circ$

78. Jason earned scores of 85, 92, and 95 on his science tests. What does he need to earn on his next science test to have an average of 93%?

The total number of points to have 4 test scores to average 93% is: $4 \cdot 93 = 372$

So... $85 + 92 + 95 + x = 372$

$272 + x = 372$

$-272 \quad -272$

$x = 100$

Jason needs to get 100%.

79. Chicken is on sale for $2.29/lb. How much would a 3 ounce serving cost?

Remember 16oz = 1 pound

$\frac{\$2.29}{16} = .143$ 14.3¢ per ounce

$3 \cdot 14.3 = 0.429 \rightarrow$ 43¢ for 3 ounces

80. The average weight of an apple is 5 ounces. Approximately how many apples are in a 5 pound bag?

$\frac{5 \text{ lbs.}}{\text{bag}} \cdot \frac{16 \text{ oz}}{1 \text{ lb.}} = \frac{80 \text{ oz}}{\text{bag}}$

A five pound bag weighs 80 oz.

# of ounces in a 5lb bag → $\frac{80}{5} = 16$ ← Average weight of one apple

There are approx. 16 apples in a 5lb. bag.