

Name \_\_\_\_\_  
Mr. Schlansky

Date \_\_\_\_\_  
Algebra II

## *Algebra II Regents Review Test*

1. What is the product of  $\sqrt[3]{4a^2b^4}$  and  $\sqrt[3]{16a^3b^2}$ ?

- 1)  $4ab^2\sqrt[3]{a^2}$                       3)  $8ab^2\sqrt[3]{a^2}$   
2)  $4a^2b^3\sqrt[3]{a}$                       4)  $8a^2b^3\sqrt[3]{a}$

2. What is the solution set of the equation  $\frac{30}{x^2-9} + 1 = \frac{5}{x-3}$ ?

- 1) {2,3}  
2) {2}  
3) {3}  
4) { }

3. Which factorization is *incorrect*?

- 1)  $4k^2 - 49 = (2k + 7)(2k - 7)$   
2)  $a^3 - 8b^3 = (a - 2b)(a^2 + 2ab + 4b^2)$   
3)  $m^3 + 3m^2 - 4m + 12 = (m - 2)^2(m + 3)$   
4)  $t^3 + 5t^2 + 6t + t^2 + 5t + 6 = (t + 1)(t + 2)(t + 3)$

4. Solve *graphically* for all values of  $x$ :  $\sqrt{x-5} + x = 7$

5. A manufacturing company has developed a cost model,  $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$ , where  $x$  is the number of items sold, in thousands. The sales price can be modeled by  $S(x) = 30 - 0.01x$ . Therefore, revenue is modeled by  $R(x) = x \cdot S(x)$ . The company's profit,  $P(x) = R(x) - C(x)$ , could be modeled by

- 1)  $0.15x^3 + 0.02x^2 - 28x + 120$                       3)  $-0.15x^3 + 0.01x^2 - 2.01x - 120$   
2)  $-0.15x^3 - 0.02x^2 + 28x - 120$                       4)  $-0.15x^3 + 32x + 120$

6. Express the following in simplest form:

$$\frac{4x^3 + 12x^2 - 5}{x + 5}$$

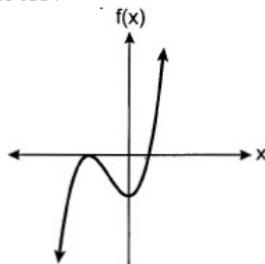
7. Is  $3x-2$  a factor of  $p(x)=3x^3-2x^2-27x+18$ ? Explain your answer.

8. Consider the polynomial  $p(x)=x^3+kx-30$ . Find a value of  $k$  so that  $x+3$  is a factor of  $P$ .

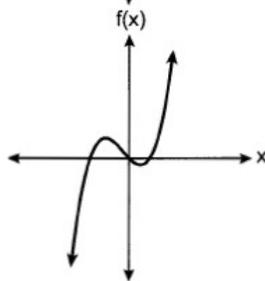
9. Does the equation  $x^2-4x+13=0$  have imaginary solutions? Justify your answer.

10. Which graph best represents the graph of  $f(x)=(x+a)^2(x-b)$ , where  $a$  and  $b$  are positive real numbers?

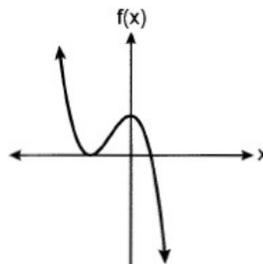
1)



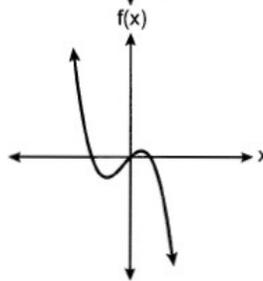
2)



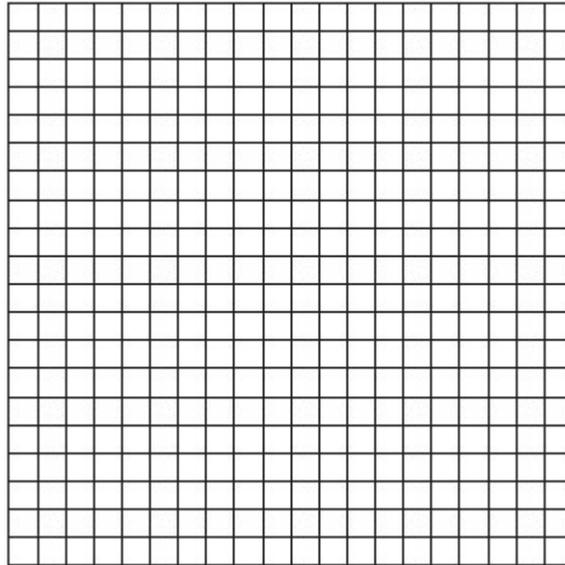
3)



4)



11. On the grid below, sketch a quartic polynomial whose factors are  $x+5$ ,  $x+2$ ,  $x-1$ , and  $x-4$ .



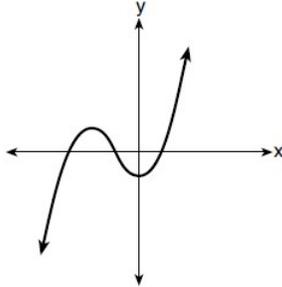
12. Consider the end behavior description below.

- as  $x \rightarrow -\infty, f(x) \rightarrow \infty$
- as  $x \rightarrow \infty, f(x) \rightarrow -\infty$

Which function satisfies the given conditions?

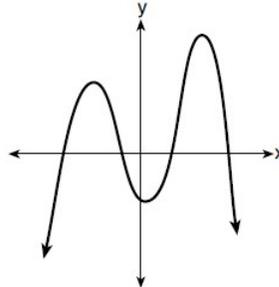
1)  $f(x) = x^4 + 2x^2 + 1$

2)



3)  $f(x) = -x^3 + 2x - 6$

4)



13. Express in *simplest a+bi* form  
 $5i + 4i(2 + 3i)$



18. For  $f(x) = x^3 + 8x^2 + 3x - 8$ , find the zeros, relative minima, and relative maxima rounded to the nearest tenth.

19. What is the inverse of the function  $y = 4x + 5$ ?

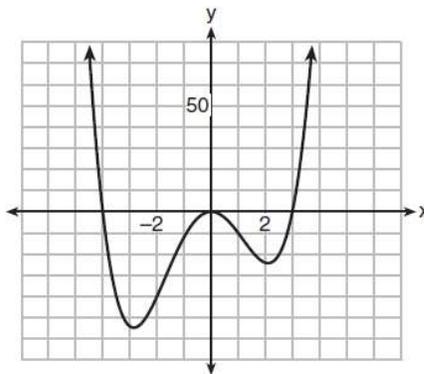
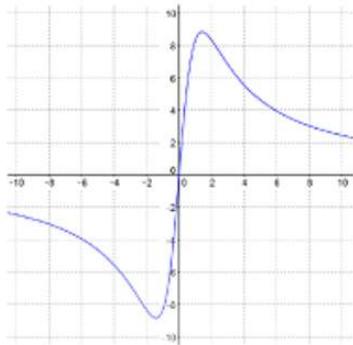
1)  $x = \frac{1}{4}y - \frac{5}{4}$

3)  $y = 4x - 5$

2)  $y = \frac{1}{4}x - \frac{5}{4}$

4)  $y = \frac{1}{4x+5}$

20. Determine whether the following functions are even, odd, or neither.



$$f(x) = -2|x| - 4$$

21. How is the parent function transformed to create  $f(x) = -(x-4)^2 + 3$ ?

22. The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function  $B(t) = 25.29 \sin(0.4895t - 1.9752) + 55.2877$ , where  $t$  is the month number (January = 1). State, to the nearest tenth, the average monthly rate of temperature change between August and November. Explain its meaning in the given context.

23. Which value is contained in the solution of the system shown below?

$$3x + y + z = -4$$

$$x - 2y + z = -5$$

$$2x + 3y - 2z = -9$$

- 1) -3                      3) -5  
 2) -4                      4) -9

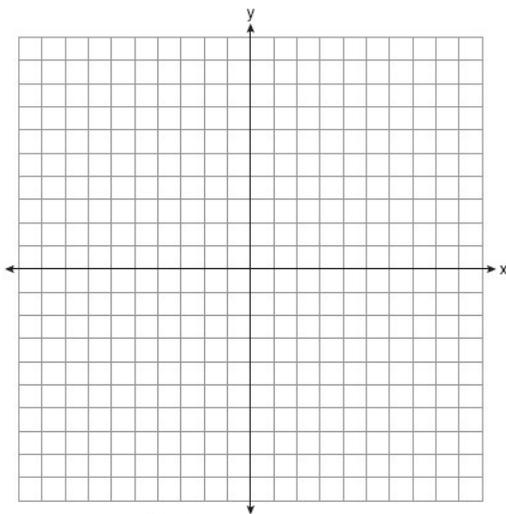
24. For  $n$  and  $p > 0$ , is the expression  $\left(p^2 n^{\frac{1}{2}}\right)^8 \sqrt{p^5 n^4}$  equivalent to  $p^{18} n^6 \sqrt{p}$ ? Justify your answer.

25. Given the equation  $f(x) = \pi^x$ , which of the following statements is true?

- 1) The graph passes through  $(\pi, 1)$   
 2) The domain is  $[0, \infty)$   
 3) The graph passes through  $(0, 1)$   
 4) The range is all real numbers

Graph the following functions on the grids provided

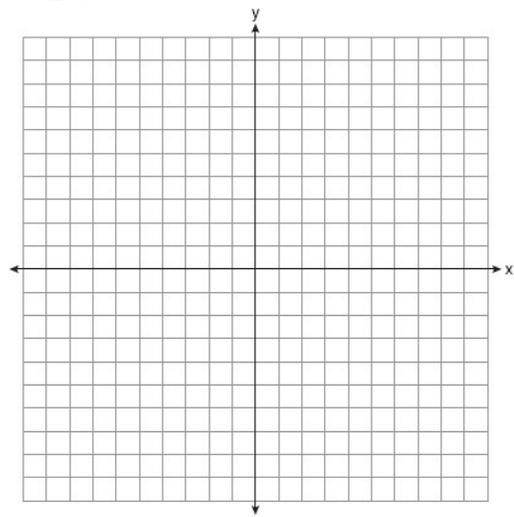
26.  $y = x^3 - 4x^2 + 2x + 7$



$$x \rightarrow -\infty, f(x) \rightarrow$$

$$x \rightarrow \infty, f(x) \rightarrow$$

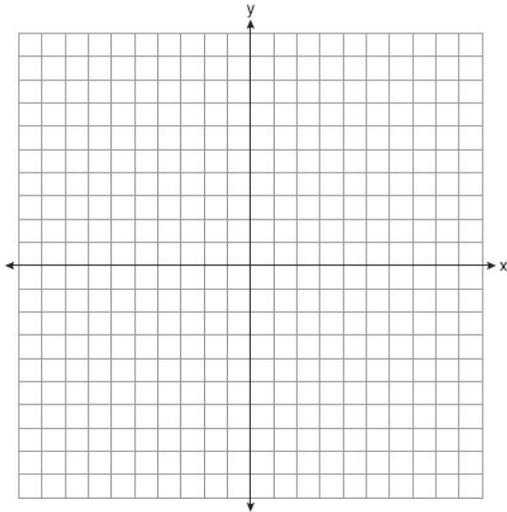
27.  $c(x) = -9(3)^{x-4} + 2$



$$x \rightarrow -\infty, f(x) \rightarrow$$

$$x \rightarrow \infty, f(x) \rightarrow$$

28.  $y = \log_2(x+9) - 3$



$x \rightarrow -9, f(x) \rightarrow$

$x \rightarrow \infty, f(x) \rightarrow$

29. The half-life of mendelevium-258 is 51.5 days. To the *nearest hundredth of a gram*, how much of a 4000 gram sample of mendelevium-258 will remain after 12 days?

30. Cassandra bought an antique dresser for \$500. If the value of her dresser increases 6% annually, what will be the value of Cassandra's dresser at the end of 3 years to the *nearest dollar*?

31. If a bank account is opened with \$4000 and is compounded at a rate of 5.2% continuously, how much money will be in the account after 3 years?

32. A bank account is opened with \$3000 and interest is compounded monthly at an interest rate of 4.2%. How much money is in the account after 8 years?

33. Phil is trying to get himself back into shape and wants to ease his way back into distance running. He will start by running 2 miles each day but every four days, he will increase his distance by 60%. How many miles will Phil be running after 10 days rounded to the *nearest mile*?

34. The value of an investment account,  $v(t)$ , can be modeled by the equation

$v(t) = 500(1.15)^{3.2t}$  after  $t$  years. Which of the following statements must be true?

- 1) The account is increasing approximately 15% each year.
- 2) The account is increasing approximately 56% each year
- 3) There will be \$1216.80 in the account after two years
- 4) It will take 3.68 years for the account to double

35. The value of a home after  $t$  years can be modeled by the function  $A = 525000(1.36)^t$  after  $t$  years. Which function would represent the monthly rate of increase after  $m$  months?

- |                             |                              |
|-----------------------------|------------------------------|
| 1) $A = 525000(1.36)^m$     | 3) $A = 525000(1.026)^m$     |
| 2) $A = 525000(1.36)^{12m}$ | 4) $A = 525000(1.026)^{12m}$ |

36. A theater with 15 rows has 10 seats in the first row, 12 seats in the second row, 14 seats in the third row, and so on. Write an explicit and recursive formula that can be used to determine the number of seats in the  $n$ th row of the theater.

37. Dana began an exercise program using a FitBit to measure her distance walked on her treadmill, in miles, per week. The following table shows her progress over three weeks.

Week	1	2	3
Distance Walked on Treadmill (miles)	9	11.7	15.21

If she continues to progress in this manner, which of the listed statements could model the number of miles Dana walks on her treadmill,  $a_n$ , in terms of  $n$ , the number of weeks?

- 1)  $a_n = 9(1.3)^n$                       2)  $a_n = 9 + 2.7(n - 1)$   
 3)  $a_1 = 9$                               4)  $a_1 = 9$   
 $a_n = 1.3a_{n-1}$                        $a_n = 2.7 + a_{n-1}$

38. If  $a_n = 3a_{n-1} - 4$  and  $a_2 = 9$ , find  $a_5$

39. Daniela invested \$2000 in a stock that increases by 1.6% each week. Which of the following recursive sequences represents the value of her stock after  $n$  weeks?

- 1)  $a_0 = 2000$                               3)  $a_0 = 2000$   
 $a_n = a_{n-1} + 1.6$                        $a_n = 1.6a_{n-1}$   
 2)  $a_0 = 2000$                               4)  $a_0 = 2000$   
 $a_n = a_{n-1} + 1.016$                        $a_n = 1.016a_{n-1}$

40. Kina earns a \$27,000 salary for the first year of work at her job. She earns annual increases of 2.5%. What is the total amount, to the *nearest cent*, that Kina will earn for the first eight years at this job?

41. A company fired several employees in order to save money. The amount of money the company saved per year over five years following the loss of employees is shown in the table below.

Which expression determines the total amount of money saved by the company over 5 years?

1)  $\frac{59,000 - 59,000(1.1)^5}{1 - 1.1}$

2)  $\frac{59,000 - 59,000(0.1)^5}{1 - 0.1}$

3)  $\sum_{n=1}^5 59,000(1.1)^n$

4)  $\sum_{n=1}^5 59,000(0.1)^{n-1}$

Year	Amount Saved (in dollars)
1	59,000
2	64,900
3	71,390
4	78,529
5	86,381.9

42. Monthly mortgage payments can be found using the formula below:

$$M = \frac{P \left( \frac{r}{12} \right) \left( 1 + \frac{r}{12} \right)^n}{\left( 1 + \frac{r}{12} \right)^n - 1}$$

$M$  = monthly payment

$P$  = amount borrowed

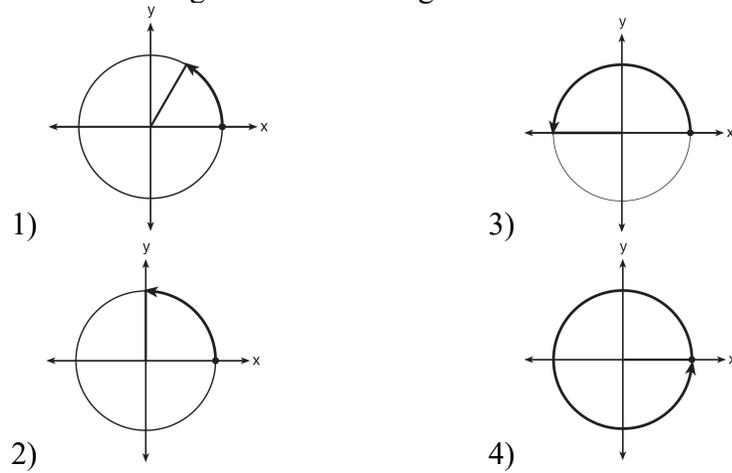
$r$  = annual interest rate

$n$  = number of monthly payments

The Banks family would like to purchase a home for \$220,000. They qualified for an annual interest rate of 4.8%. If they put make a down payment of \$100,000 and plan to spend 15 years to repay the loan, what will be the monthly payment rounded to the *nearest* cent?

If they want their monthly payment to be \$1500, what would their down payment have to be?

43. Which diagram shows an angle rotation of 1 radian on the unit circle?

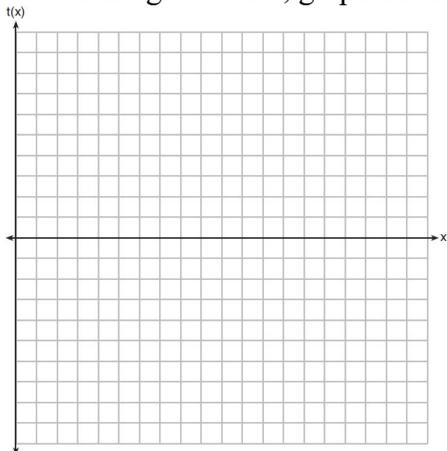


44. If  $\tan \theta = \frac{24}{7}$  and  $\theta$  is in Quadrant III, find:

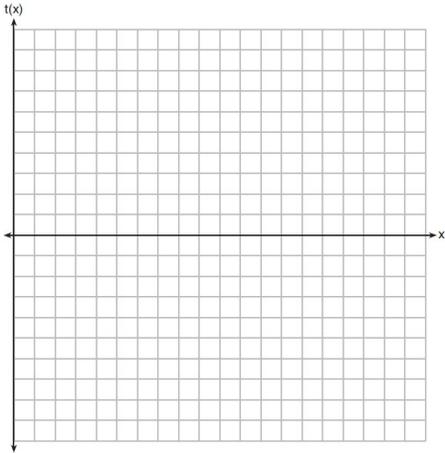
a)  $\cos \theta$                       b)  $\sin \theta$                       c)  $\tan \theta$

d)  $\sec \theta$                       e)  $\csc \theta$                       f)  $\cot \theta$

45. On the grid below, graph one full cycle of  $y = -3 \sin \pi x + 2$

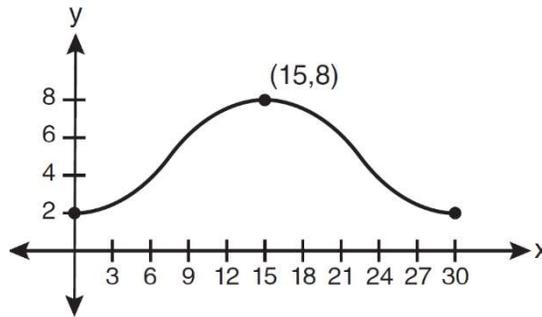


46. On the grid below, graph  $y = 3 \cos 2x + 1$  over the domain  $[0, 2\pi]$



47. Which equation is graphed in the diagram below?

- 1)  $y = 3 \cos\left(\frac{\pi}{30}x\right) + 8$
- 2)  $y = 3 \cos\left(\frac{\pi}{15}x\right) + 5$
- 3)  $y = -3 \cos\left(\frac{\pi}{30}x\right) + 8$
- 4)  $y = -3 \cos\left(\frac{\pi}{15}x\right) + 5$



48. Consider the function  $h(x) = 2 \sin(3x) + 1$  and the function  $q$  represented in the table below. Determine which function has the *smaller* minimum value for the domain  $[-2, 2]$ . Justify your answer.

$x$	$q(x)$
-2	-8
-1	0
0	0
1	-2
2	0

49. As  $\theta$  increases from  $-\frac{\pi}{2}$  to 0 radians, the graph of  $y = -\cos \theta$  will

- 1) Decrease from 1 to 0
- 2) Decrease from 0 to -1
- 3) Increase from -1 to 0
- 4) Increase from 0 to 1

50. The probability of event A is .46. The probability of event B is .31. The probability of both events happening is .19. What is the probability that event A or event B happens?

51. The probability of event A happening is 28% and the probability of event B happening is 41%, The probability that event A or event B happens is 30%. What is the probability that event A and event B happens?

52. On a given school day, the probability that Cristian is late is 22% and the probability he has a does his homework is 62%. Assuming these two events are independent, what is the probability that Cristian oversleeps and does his homework on the same day?

53. A statistics class surveyed some students during one lunch period to obtain opinions about television programming preferences. The results of the survey are summarized in the table below.

**Programming Preferences**

	<b>Comedy</b>	<b>Drama</b>
<b>Male</b>	70	35
<b>Female</b>	48	42

What is the probability that a student is male and prefers comedy?

What is the probability that a male student would prefer comedy?

What is the probability that a student is male?

What is the probability that a student is female given that they like drama?

54. The results of a survey of the student body at Central High School about television viewing preferences are shown below.

	Comedy Series	Drama Series	Reality Series	Total
Males	95	65	70	230
Females	80	70	110	260
Total	175	135	180	490

Are the events “student is a male” and “student prefers reality series” independent of each other? Justify your answer.

55. The scores of a recent test taken by 1200 students had an approximately normal distribution with a mean of 225 and a standard deviation of 18. Determine the number of students who scored higher than 240

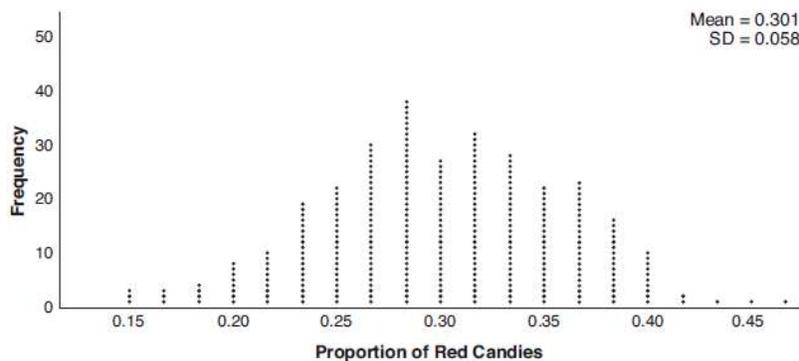
56. Which scenario is best described as an observational study?

- 1) For a class project, students in Health class ask every tenth student entering the school if they eat breakfast in the morning.
- 2) A social researcher wants to learn whether or not there is a link between attendance and grades. She gathers data from 15 school districts.
- 3) A researcher wants to learn whether or not there is a link between children's daily amount of physical activity and their overall energy level. During lunch at the local high school, she distributed a short questionnaire to students in the cafeteria.
- 4) Sixty seniors taking a course in Advanced Algebra Concepts are randomly divided into two classes. One class uses a graphing calculator all the time, and the other class never uses graphing calculators. A guidance counselor wants to determine whether there is a link between graphing calculator use and students' final exam grades.

57. A survey is to be conducted in a small upstate village to determine whether or not local residents should fund construction of a skateboard park by raising taxes. Which segment of the population would provide the most unbiased responses?

- 1) a club of local skateboard enthusiasts
- 2) senior citizens living on fixed incomes
- 3) a group opposed to any increase in taxes
- 4) every tenth person 18 years of age or older walking down Main St.

58. Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.

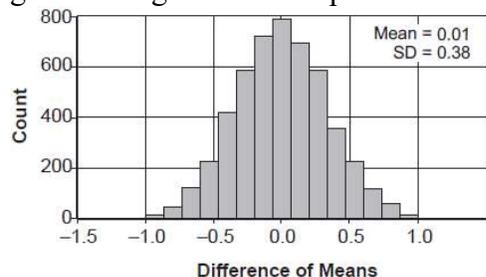


Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within. Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

59. Juanita rolls a 6 sided die and recorded that it landed on 6 five times out of 50. She questioned whether the die was fair so she ran a computer simulation of 1000 samples of 50 rolls of a fair die. The mean of the simulation was .159 with a standard deviation of .102. Is her die fair? Explain your answer.

60. Two classes of students were entered into an experiment to see whether using an interactive whiteboard leads to better grades. It was observed that the mean grade of students in the class with the interactive whiteboard was 0.6 points higher than the class without it. To determine if the observed difference is statistically significant, the classes were rerandomized 5000 times to study these random differences in the mean grades. The output of the simulation is summarized in the histogram below.

Determine an interval containing the middle 95% of the simulation results. Round your answer to the *nearest hundredth*. Does the interval indicate that the difference between the classes' grades is significant? Explain.



61. A cup of coffee is left out on a countertop to cool. The table below represents the temperature,  $F(t)$ , in degrees Fahrenheit, of the coffee after it is left out for  $t$  minutes. Based on these data, write an exponential regression equation,  $F(t)$ , to model the temperature of the coffee. Round all values to the *nearest thousandth*. What would be the estimate of the temperature of the coffee after 17 minutes to the nearest tenth of a degree?

<b>t</b>	0	5	10	15	20	25
<b>F(t)</b>	180	144	120	104	93.3	86.2

62. The Fahrenheit temperature,  $F(t)$ , of a heated object at time  $t$ , in minutes, can be modeled by the function below.  $F_s$  is the surrounding temperature,  $F_0$  is the initial temperature of the object, and  $k$  is a constant.

Hot chocolate at a temperature of  $200^\circ\text{F}$  is poured into a container. The room temperature is kept at a constant  $68^\circ\text{F}$  and  $k = 0.05$ . What will be the temperature of the hot chocolate after 10 minutes has passed to the *nearest degree*.

$$F(t) = F_s + (F_0 - F_s)e^{-kt}$$

63. Factor the following

a)  $36 - 25x^2$

b)  $x^2 - 7x + 12$

c)  $3x^2 + 9x - 12$

d)  $6x^2 - 54$

e)  $2x^2 + 7x - 4$

f)  $x^3 + 3x^2 - 9x - 27$

g)  $3x^3 + x^2 - 12x^2 - 4x - 63x - 21$

h)  $(x^2 - 2x)^2 - 11(x^2 - 2x) + 24$

i)  $y^3 - 125$

64. Express in simplest form:

$$\frac{6 - 2x}{x^2 - 9}$$

65. Solve  $x(x-3) = 4x+30$  algebraically

66. Solve the equation  $x^2 + 2x = -6$  algebraically and express the answer in simplest  $a + bi$  form.

67. Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

68. Solve the following equation algebraically for all values of x:

$$\sqrt{x-5} + x = 7$$

68. Solve the following equation algebraically for all values of x:

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

69. Solve the following equation algebraically for all values of  $x$  rounding to the *nearest tenth*:  
 $8 + 2(4)^{-5x} = 14$

70. Solve the following system of equations algebraically for all values of  $x$  and  $y$ .

$$x^2 + y^2 = 25$$

$$y + 5 = 2x$$

71. Solve the following system of equations algebraically for all values of  $x$ ,  $y$ , and  $z$ :

$$2x + 3y - 4z = -1$$

$$x - 2y + 5z = 3$$

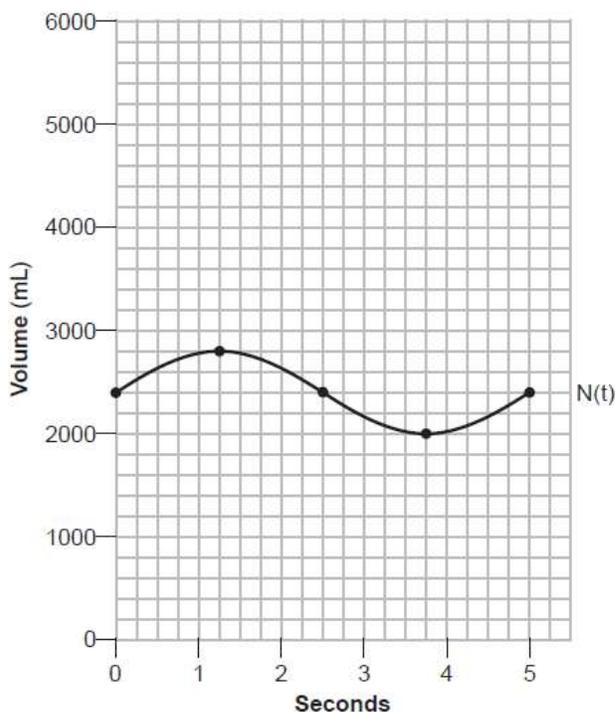
$$-4x + y + z = 16$$

72. A house purchased 5 years ago for \$100,000 was just sold for \$135,000. Assuming exponential growth, approximate the annual growth rate, to the *nearest percent*.

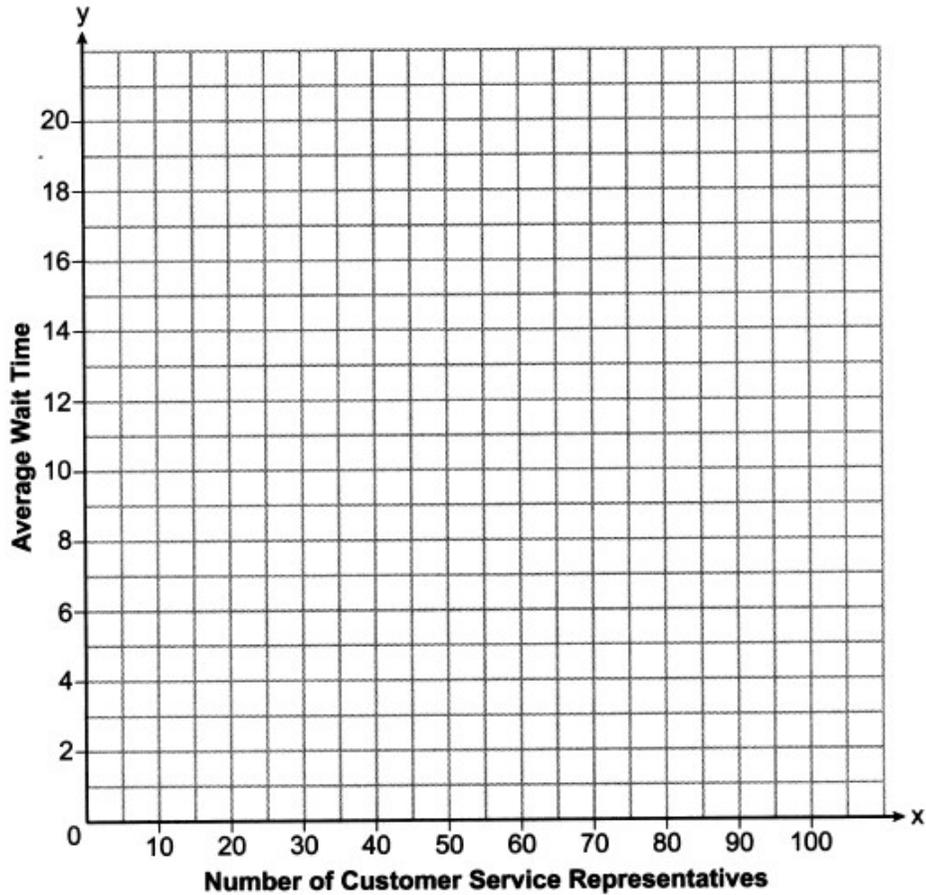
73. The half-life of a radioactive substance is 15 years. Write an equation that can be used to determine the amount,  $s(t)$ , of 200 grams of this substance that remains after  $t$  years. Determine algebraically, to the *nearest year*, how long it will take for  $\frac{1}{10}$  of this substance to remain.

74. Determine, to the *nearest tenth of a year*, how long it would take an investment to double at a 3.75% interest rate, compounded continuously.

75. The volume of air in an average lung during breathing can be modeled by the graph below. Using the graph, write an equation for  $N(t)$ , in the form  $N(t) = A \sin(Bt) + C$ . That same lung, when engaged in exercise, has a volume that can be modeled by  $E(t) = 2000 \sin(\pi t) + 3200$ , where  $E(t)$  is volume in mL and  $t$  is time in seconds. Graph *at least one cycle* of  $E(t)$  on the same grid as  $N(t)$ . How many times during the 5-second interval will  $N(t) = E(t)$ ?



76. A technology company is comparing two plans for speeding up its technical support time. Plan  $A$  can be modeled by the function  $A(x) = 15.7(0.98)^x$  and plan  $B$  can be modeled by the function  $B(x) = 11(0.99)^x$  where  $x$  is the number of customer service representatives employed by the company and  $A(x)$  and  $B(x)$  represent the average wait time, in minutes, of each customer. Graph  $A(x)$  and  $B(x)$  in the interval  $0 \leq x \leq 100$  on the set of axes below.



To the *nearest integer*, solve the equation  $A(x) = B(x)$ . Algebraically determine how many customer service representatives Plan A would need for the average wait time to be 1.5 minutes rounded to the *nearest representative*.

77. Using a microscope, a researcher observed and recorded the number of bacteria spores on a large sample of uniformly sized pieces of meat kept at room temperature. A summary of the data she recorded is shown in the table below.

Using these data, write an exponential regression equation, rounding all values to the *nearest thousandth*. The researcher knows that people are likely to suffer from food-borne illness if the number of spores exceeds 100. Using the exponential regression equation, determine the maximum amount of time, to the *nearest tenth of an hour*, that the meat can be kept at room temperature safely.

Hours (x)	Average Number of Spores (y)
0	4
0.5	10
1	15
2	60
3	260
4	1130
6	16,380

78. Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

$T_0$ : initial temperature

$T_R$ : room temperature

$r$ : rate of cooling of the object

$t$ : time in minutes that the object cools to a temperature,  $T$

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt,  $T$ , after  $t$  minutes. Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes. At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*. The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.