# Algebra II 2017 EOC Review

Name: _____

Period: _____

**1)** Select all of the solutions to the equation: $2|x + 2| - 1 = 9$

    **a) 6**       **b) -10**      **c) 2**       **d) -6**      **e) 3**

    **f) -3**     **g) 7**     **h) -7**

**2)** Avery inherited a grandfather clock from her family that has a pendulum. The period, T, of a clock pendulum can be found using the equation shown: $T = 2\pi \sqrt{\dfrac{L}{g}}$ where L is the length of the rod of the pendulum in feet and g represents gravity in $ft/sec^2$.

a) Rewrite the equation so that Avery can find the length, L, of the pendulum rod.

b) Find the length of the pendulum rod in feet if the gravity is assumed to be 32 $ft/sec^2$ and the period T is 1.5 seconds. Round to the nearest hundredth of a foot if necessary.

**3)** A ski slope on Mt. Holcomb has a trail, when superimposed on a coordinate plane, begins at the point (-10, 3) and ends at the point (-2, -1). Paige found the slope of the trail using the following method. Find and explain her mistake, then find the correct slope.

$$m = \frac{-2-(-10)}{-1-3} = \frac{8}{-4} = -2$$

**4)** Are the equations $y = 3x - 5$ and $-3y + 6 = x$ parallel, perpendicular, or neither? Explain.

**5)** The following graph is a piecewise function.
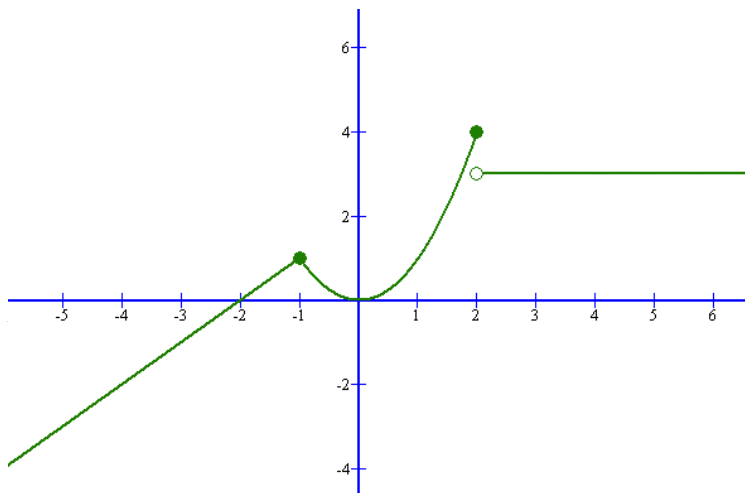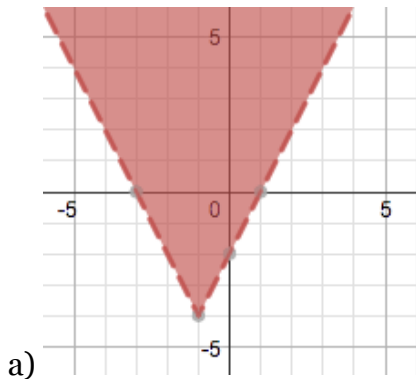


Which of the following statements are true about the graph? Select all that apply.
a. The graph is increasing when $x \le -1$.
b. The graph has two relative minimums.
c. The graph is decreasing when $0 \le x \le 2$.
d. The graph is decreasing when $-1 \le x < 0$.
e. The graph is increasing when the domain is $(-\infty, -1) \cup (0,2)$.
f. The range of the function is all real numbers.

**6)** Which graph matches the equation?

$$y \geq 2|x + 1| - 4$$

a)

b)

c)

d)
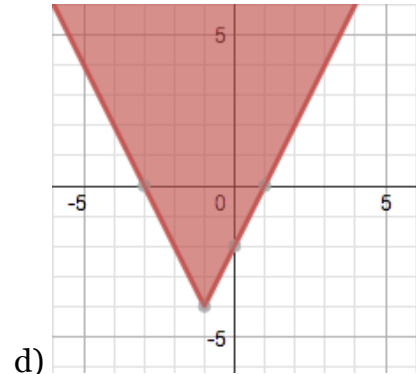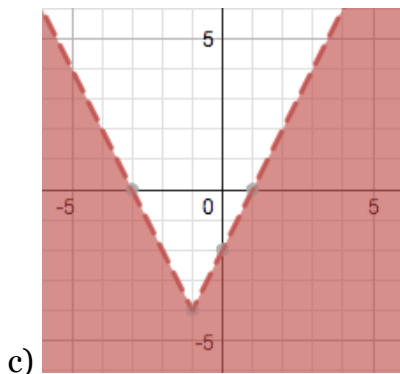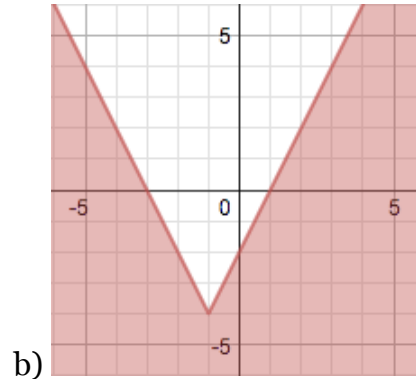
**7)** The Chilis High School SGA has a budget of $5400 to buy 200 shirts. They can choose from tank tops for $12 each, t-shirts for $24 each, and hoodies for $36 each. If they want to have twice as many hoodies as t-shirts, how many of each type should they buy?

**8)** When solving a quadratic equation in Standard Form for y = 0, the real solutions can always be referred to as: _____ (select all that apply)

   A. Answers
   B. Solutions
   C. Y-Intercepts
   D. X-Intercepts
   E. Discriminant
   F. Zeros
   G. Maximum/Minimum
   H. Roots

**9)** Explain how to find the distance from the focus to the directrix of the parabola y = 4x², then find the distance.

**10)** Logan is competing in a golf tournament for his school.  At the third hole, he hits a shot off the tee that has a height modeled by the function $h(t) = -16t^2 + 80t$, where $h(t)$ is the height of the ball, in feet, and **t** is the time in seconds it has been in the air.

a) Why is the y-intercept in this function?

b) When does the ball reach its maximum height?

c) What is the maximum height of the ball?

d) What is the height of the ball at 3.5 seconds?

e) After approximately how many seconds is the ball 65 feet in the air?  Explain.

f) How long does it take until the golf ball hits the ground?

**11) Error Analysis**:  A student used synthetic division to divide $(x^3 + 2x^2 - 4)$ by $(x + 2)$ and concluded that the remainder was -4. Explain the student's error, then complete the division correctly and state the remainder.

```
-2 |  1    2    -4
   |      -2     0
   _____
      1    0    -4
```

**12)  Explain:**  A quartic equation with integer coefficients has two real roots and one irrational root. Explain why the fourth root must be irrational.

**13)  Write an equation:**  Determine the cubic function obtained from the parent function $y = x^3$ when the following sequence of transformations take place:
- A reflection across the x-axis
- A shift left of 3 units
- A shift down of 2 units

**14)** A polynomial function, $f(x) = x^4 - 5x^3 - 28x^2 + 188x - 240$, is used to model a new roller coaster section. The loading zone will be placed at one of the zeroes. The function has a zero at 5. What are the possible locations for the loading zone?

**15)** Choose all that simplify to 4.

**a)** $(2^3)^{2/3}$      **b)** $\sqrt{\left(2^{1/2}\right)^8}$      **c)** $16^{1/4}$      **d)** $\sqrt[4]{64}$      **e)** $\left(\sqrt[3]{64}\right)^2$      **f)** $\sqrt{16}$

**g)** $\left(\sqrt[3]{8}\right)^2$      **h)** $\left(\frac{1}{16}\right)^{1/2}$

**16)** A grocery store is offering a 50% discount for a $6 bag of pizza rolls. You also have coupon for $1 off. **Write a composite function** for each scenario:
- Using the coupon before the store discount.
- Using the coupon after the store discount.

Calculate and explain which scenario is the least expensive.

**17)** Explain why the expansion below is incorrect. Then do the expansion correctly.

$$\log_3 \sqrt{\frac{x}{2}}$$
$$= \frac{1}{2}\log_3 \frac{x}{2}$$
$$= \frac{1}{2}\log_3 x - \log_3 2$$

**18)** Mrs. Harris runs a biology lab, and she is facilitating a project with her students. They have a bacteria culture that starts with 3,000 bacteria and grows to a population of 12,000 after three hours.
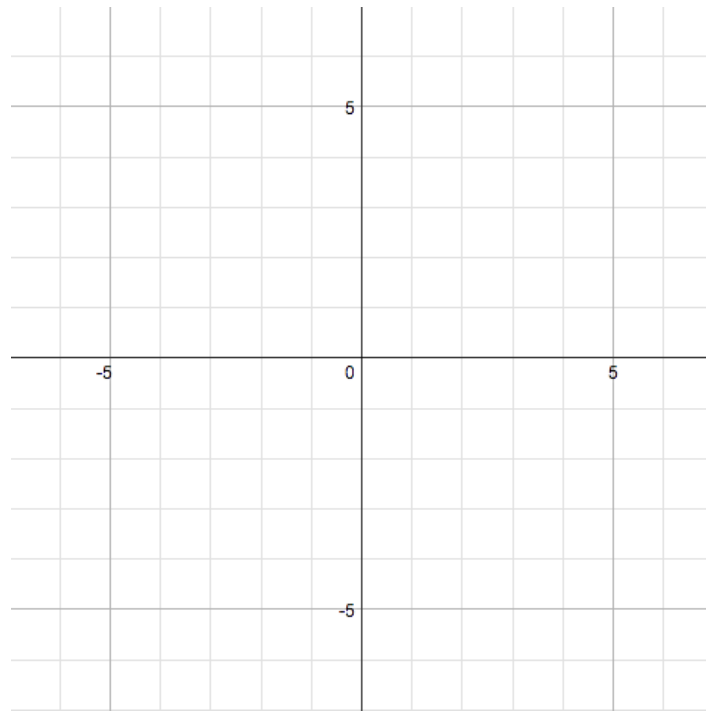**Part A:** Find the doubling period.
**Part B:** Write a function to represent the population $P$ after $t$ hours.
**Part C:** Determine the number of bacteria after 8 hours.

**19)** Graph the rational function:

$$y = \frac{x^2 + x - 6}{x^2 - 4}$$



**20) Select all that apply:**  Use the following sequence and select all answers that apply:

23, 30, 37, 44, ...

A) The sequence is arithmetic.

B) The sequence is geometric.

C) The sequence has a common difference of 7.

D) The next term is 50.

E) The common ratio is 7.

F) The $32^{nd}$ term is 240.

G) The sum of the first 6 terms is 243.

H) The sum of the first 4 terms is 135.

**21)** Jace is in his fifth year of employment as a sheriff's deputy in the local Sheriff's Office. His salary for his first year of employment was $47,000. Each year, after the first year, his salary increased by 4% of his salary the previous year.

Part A

What is the sum of Jace's salaries for his first five years of service?
- A. $101,983
- B. $188,000
- C. $219,932
- D. $254,567

Part B

If Jace continues his employment at the same rate of increase in yearly salary, for which year will his salary first <u>exceed</u> $100,000?

Part C

Describe your steps in calculating the number of years in Part B.

**22)** Select all that are true for the given equation: $y = (x - 2)^2 + 4$
- a) Vertex (2, 4)
- b) Vertex (-2, 4)
- c) Focus (2, 4.25)
- d) Axis of symmetry x = -2
- e) Directrix y = 3.75
- f) Standard form $y = x^2 - 4x + 8$
- g) Maximum value y = 4
- h) Shifted 2 to the right and 4 up from the parent graph

**23)** In 2010, the population of Tallahassee was 186,411. Of that number, 17.2% were under the age of 18 and 52.9% were female. Complete the table to show a possible breakdown of the Tallahassee population.

|  | Under 18 Years | 18 Years and Over | Total |
|---|---|---|---|
| # Male |  |  |  |
| # Female |  |  |  |
| Total |  |  | 186,411 |

**24)** The graph models the height h above the ground, in feet, at time t, in seconds, of a person swinging on a swing. Each point indicated on the graph represents the height of the person above the ground at the end of each one-second interval.

Select **two** time intervals for which the average rate of change in the height of the person is approximately $-\dfrac{1}{2}$ feet per second.

___from 0 seconds to 1second
___from 1second to 2 seconds
___from 2 seconds to 3 seconds
___from 3 seconds to 4 seconds
___from 4 seconds to 5 seconds
___from 5 seconds to 6 seconds
___from 6 seconds to 7 seconds
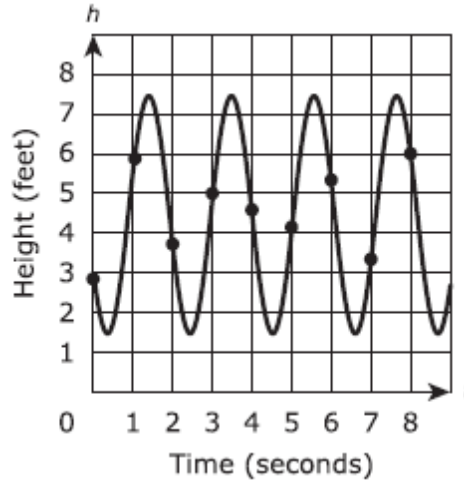


**25)** What is the expanded form of $3x(x + 2)^2$ ?

**26)** A company manufactures heating cable. The cable sells for $4.50 per foot. The cost, in dollars, of producing the heating cable is $3\sqrt{x}$, where $x$ is the length of the heating cable, in feet. The company makes a profit of $1053 on each spool of heating cable.

Drag expressions to the boxes and symbols to the circles to create an equation that can be used to find how many feet of heating cable are on each spool.

| 234 |
| 1053 |
| 4.5x |
| 234x |
| 1053x |
| $3\sqrt{x}$ |
| $3x\sqrt{x}$ |
| 13.5$\sqrt{x}$ |
| + |
| − |
| • |
| ÷ |
| = |

**27)** An equation is shown.

$$7^{\frac{19}{4}} \cdot \sqrt[a]{7^b} = 7^{\frac{9}{4}} \cdot \sqrt{7^3}$$

What are possible values for a and b that make this equation true?

$a = $ ____

$b = $ ____

**28)** Jared is opening several ice cream stores. The walls of the stores can be yellow or blue. He designs an experimental study to determine if the color of the walls affects how much ice cream people eat.

Jared finds 164 volunteers. He randomly assigns half of them to a room with yellow walls and lets them eat as much chocolate ice cream as they want for one hour. He assigns the other half to a room with blue walls and lets them eat as much vanilla ice cream as they want for one hour.

Jared records the total amount of ice cream eaten in each room.

What is one flaw in Jared's study?

Ⓐ There are too many volunteers.

Ⓑ The room assignments were random.

Ⓒ The groups had different flavors of ice cream.

Ⓓ The groups did not have different numbers of volunteers.

**29)** Marcy plays a game with a spinner and a 6-sided number cube. The spinner is divided into 4 equal sections numbered 1 to 4. Marcy spins the spinner and rolls the number cube. She records both numbers.

What is the probability that at least one of the numbers is a 4?

**30)** The number of *Salmonella* bacteria, y, in a sample after M minutes can be found using the equation $y = 1200(2^{\frac{2}{5}M})$. To the nearest tenth of a minute, how many minutes will it take for the sample to have 100,000 bacteria?

**31)** Amanda bought a new car for $17,850. Her new car will lose 11% of its value the moment she drives the car off the car dealership's lot. Over the next five years, Amanda's car will depreciate 20.5% each year. After five years, her car will hold its value at 27% of its original cost.

Select the appropriate definition and domain for the variable $x$ for the equation that models the value of Amanda's car, $C$. Then, select the correct equation.

A. Select a definition for the variable $x$.
• $x$ is the number of years since Amanda's car left the car dealership's lot.
• $x$ is the number of years since the value of Amanda's car reached 20.5% of its original cost.
• $x$ is the number of years Amanda's car was at 27% of its original cost.

B. Select the domain that best fits the situation.
• all real numbers
• $0 \leq x \leq 5$
• $x \geq 0$

C. Select the equation that can be used to model the value of Amanda's car.
• $C = 17,850(1 - 0.585)^x$
• $C = 15,886.5(1 - 0.205)^x$
• $C = 6,604(1 - 0.27)^x$

**32)** Whenever Cassie rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

**33)** The equation 2x² – 5x = -12 is rewritten in the form of 2(x – p)² + q = 0 . What is the value of q?

A) $\dfrac{167}{16}$    B) $\dfrac{71}{8}$    C) $\dfrac{25}{8}$    D) $\dfrac{25}{16}$

**34)** A board is made up of 9 squares. A certain number of pennies is placed in each square, following a geometric sequence. The first square has 1 penny, the second has 2 pennies, the third has 4 pennies, etc. When every square is filled, how many pennies will be used in total?

A) 512          B) 511          C) 256      D) 81

**35)** Consider the expression $3^x - 3^{x-2}$.
**Part A**
Which expression is an equivalent form of the given expression?
A) $3^x - 9(3^x)$
B) $3^x - 2(3^x)$
C) $3^x - \dfrac{1}{2}(3^x)$
D) $3^x - \dfrac{1}{9}(3^x)$

**Part B**
The expression can also be rewritten in the form $a(3^x)$, where $a$ is a constant. What is the value of $a$?

A) $\dfrac{1}{9}$     B) $\dfrac{1}{2}$     C) $\dfrac{8}{9}$     D) $\dfrac{3}{2}$

**36)**

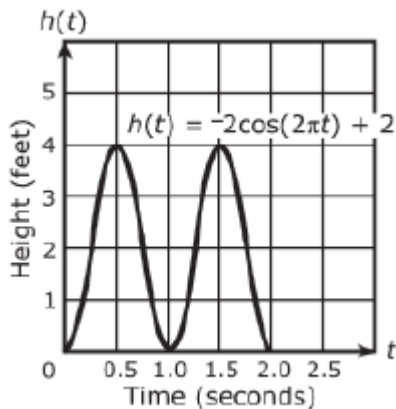| Consider the equation $p^2 - 5p - 6 - x(p - 6)^2 = 0$, where $p$ is a real constant. | |
|---|---|
| **Part A**<br>If $p = 6$, then the equation has<br><br>o  A.  no real solutions<br><br>o  B. exactly one real solution<br><br>o  C. exactly two real solutions<br><br>o  D. infinitely many real solutions | **Part B**<br>If $p \neq 6$, then $x =$<br><br>o  A. $\dfrac{p-2}{p-6}$<br><br>o  B. $\dfrac{p-1}{p-6}$<br><br>o  C. $\dfrac{p+1}{p-6}$<br><br>o  D. $\dfrac{p+2}{p-6}$ |

**37)** Let $f(x) = 2x^2 - x + 1$ and let $g(x) = x - 4$. Which statements are true? Select all that apply.

o   A. One root of $f(x)$ is $-4$.

o   B. One root of $f(x)$ is 29.

o   C. If $f(x)$ is divided by $g(x)$, the remainder is 29.

o   D. $g(x)$ is a factor of $f(x)$.

o   E. $g(x)$ is not a factor of $f(x)$.

**38)**

| Lara is jumping rope for exercise. The function $h(t) = -2\cos(2\pi t) + 2$ gives the height of the midpoint of the rope, in feet, after t seconds. The graph of the function is given for the time interval $0 \le t \le 2$. | | |
|---|---|---|
|  | Select ALL the intervals over which there is a negative average rate of change in the height of the midpoint of the rope. | Select all that apply.<br><br>o   A. $0 < t < 0.5$<br><br>o   B. $0 < t < 1$<br><br>o   C. $0.5 < t < 1$<br><br>o   D. $1 < t < 2$<br><br>o   E. $1.5 < t < 2$ |

**39)** Anjali uses the function $p = f(n) = 30n - 450$ to calculate the profit, $p$, in dollars that she makes from selling $n$ cakes in her store.

a) Write a formula for a function to calculate the number of cakes Anjali needs to sell for a given profit.

Formula: $n = f^{-1}(p) = $ _____

b) Calculate the minimum number of cakes that Anjali must sell to make a profit of at least $500.00.

Minimum number of cakes: _____

**40)** Suppose that $\Theta$ is a second quadrant angle and that $\cos\theta = -\frac{4}{5}$. What is the value of $\sin\theta$ to the nearest tenth?  $\sin\theta = $ _____

References : https://www.youtube.com/watch?v=1m9p9iubMLU
https://www.youtube.com/watch?v=cIVpemcoAlY

## 41)

T.C. has a savings account.  She deposited $1,000 into the account the first year.  For each year after the first, she plans to deposit an amount that is 2 *percent* greater than the amount deposited the preceding year.  If she makes no other deposits, the total amount of the deposited money in year $n$ is the sum $S_n$ of a geometric series of n terms.

| Part A | Part B |
|---|---|
| The formula for $S_n$ can be expressed as $\frac{1,000(1-r^n)}{1-r}$.  Use the information given about TC's account to determine the value of r. <br><br> _____ | T.C. will have deposited approximately how much by year 30? <br> o  A. $ 30,000 <br><br> o  B. $ 35,729 <br><br> o  C. $40,568 <br><br> o  D. $87,453 |

## 42)

The weight of a bag of Brand A cookies is labeled as 4 ounces on the bag.  However, the actual weights of the bags vary by a small amount.  According to the packaging specifications, the weights are approximately normally distributed with a mean of 4.10 ounces and a standard deviation of 0.10 ounce.

| Part A | Part B |
|---|---|
| Select the number to complete the sentence. <br><br> According to the specifications, approximately _____ percent of the bags weigh 4.00 ounces or more. <br> o  A. 25 <br> o  B. 34 <br> o  C. 50 <br> o  D. 84 | During a quality control check on the bag weights, a bag was found that weighed 3.95 ounces.  How many standard deviations below the mean was the bag weight? <br><br> _____ standard deviations |

Reference :   https://www.youtube.com/watch?v=MRqtXL2WX2M

**43)** Consider the functions f(x) and g(x ) described by the equations and the functions h(x ) and k(x ) shown by graphs.

| $f(x) = 3x^2$ | $g(x) = -x^3 + 5$ | | |
|---|---|---|---|
| | | h (x) | k (x) |
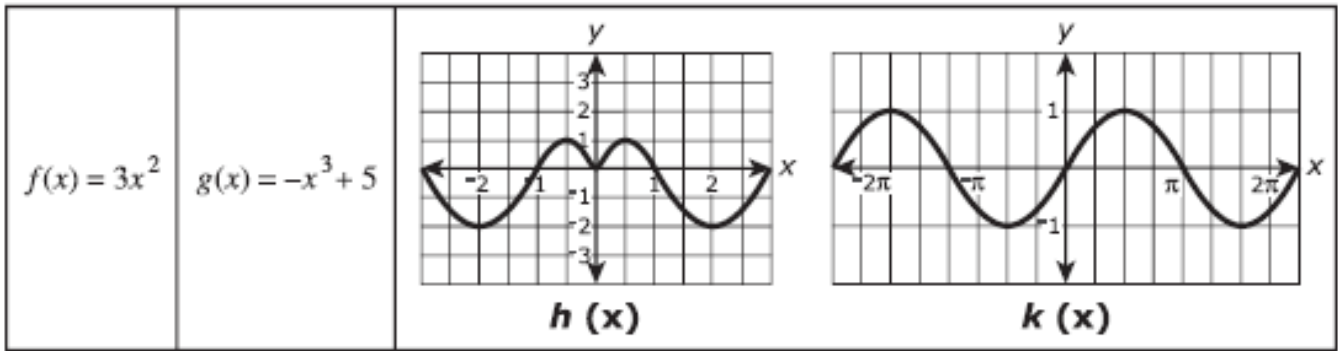
**Which of the statements are true? Select all that apply.**
A) f is an odd function.
B) f is neither an even nor odd function.
C) g is an even function.
D) g is neither an even nor odd function.
E) h is an even function.
F) h is an odd function.
G) k is an odd function.

Reference : https://www.google.com/search?q=even+odd+functions&ie=utf-8&oe=utf-8

**44)** The graph represents the temperature, in degrees Fahrenheit ( ), of tea for the first 120 minutes after it was poured into a cup.
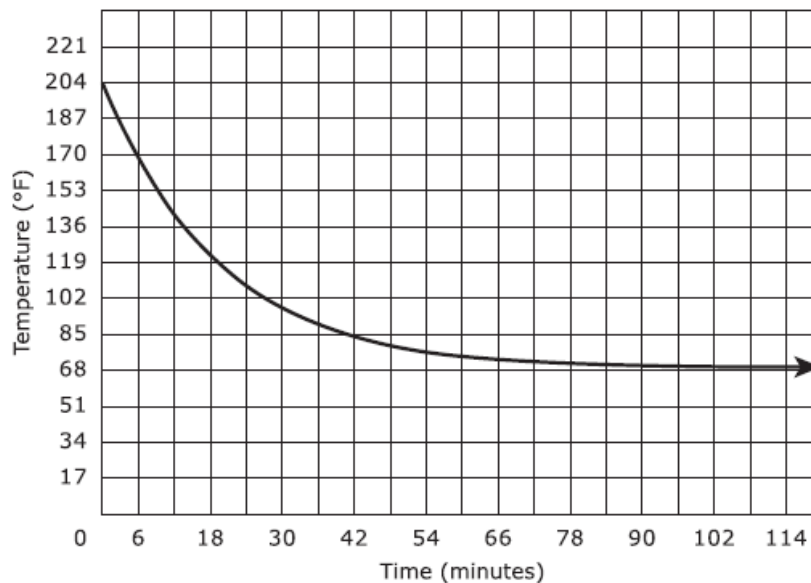
**Part A**
Based on the graph, what was the temperature of the tea when it was first poured into the cup?
A) 68°        B) 114°        C) 136°        D) 204°

**Part B**
Based on the graph, as the number of minutes increased, what temperature did the tea approach?
A) 68°        B) 114°        C) 136°        D) 204°

**45)** Casey started to train for a marathon. The table shows the number of miles Casey ran during each of the first three weeks after she began training.

| Week | 1 | 2 | 3 |
|---|---|---|---|
| Distance (miles) | 10 | 12 | 14.4 |

If this pattern continues, which of the listed statements could model the number of miles Casey runs, $a_n$, in terms of the number of weeks, n, after she began training? Select **ALL** that apply.

A) $a_n = 10 + 2(n-1)$
B) $a_n = 10n^2$
C) $a_n = 10(1.2)^{n-1}$
D) $a_1 = 10, \ a_n = 1.2a_{n-1}$
E) $a_1 = 10, \ a_n = 2 + a_{n-1}$

**46)** The distribution of weights (rounded to the nearest whole number) of all boxes of a certain cereal is approximately normal with mean 20 ounces and standard deviation 2 ounces. A sample of the cereal boxes was selected, and the weights of the selected boxes are summarized in the histogram shown.
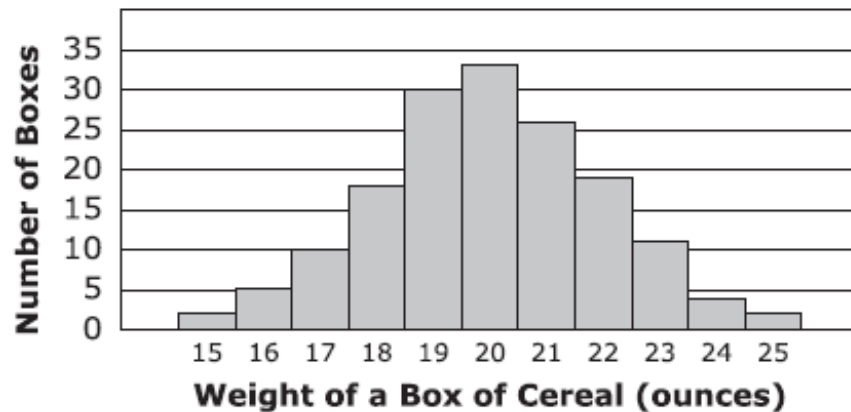


**Part A**
If w is the weight of a box of cereal, which range of weights includes all of the weights of cereal boxes that are within 1.5 standard deviations of the mean?

A) $17 \leq w \leq 23$          B) $18.5 \leq w \leq 21.5$
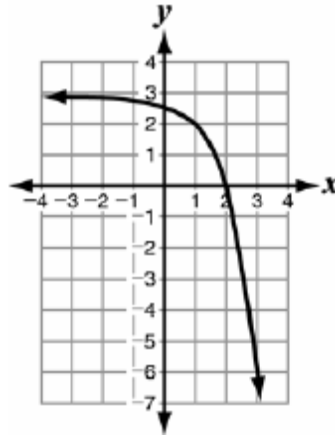C) $19 \leq w \leq 21$          D) $20 \leq w \leq 23$

**Part B**
Which of these values is the best estimate of the number of boxes in the sample with weights that are more than 1.5 standard deviations above the mean?

A) 2          B) 6          C) 17          D) 36

**47)** Which function is represented by the graph?

A) $y = -3^x + 3$

B) $y = -\left(\dfrac{1}{3}\right)^x + 3$

C) $y = -3^{x-1} + 3$

D) $y = -\left(\dfrac{1}{3}\right)^{x-1} + 3$

**48)** Trey is buying a car for $8,000. The value of the car will decrease by 5% each year. Which equation can he use to predict the value of the car after 3 years?

A) $y = 8000(0.05)^3$

B) $y = 8000(0.95)^3$

C) $y = 8000(1 - 0.05)^3$

D) $y = 8000(1 + 0.05)^3$

**49)** What are the real zeros of $f(x) = x^3 + 6x^2 - 13x - 42$?

A) -7, -3, -2

B) -7, 3, -2

C) -7, 3, 2

D) 7, 3, -2

**50)** A circular spinner is divided into five sectors of different colors. A student spun the arrow on the spinner 200 times and recorded that the arrow stopped on the orange sector 38 times out of the 200 spins. To test whether the spinner was fair, the student used a computer to simulate the number of times the arrow stops on orange in 200 spins of a fair spinner equally divided into five sectors of different colors. The results of 1,000 trials of the simulation are shown.

Based on the results of the simulation, is there statistical evidence that the spinner is not fair?

**Simulation Results**
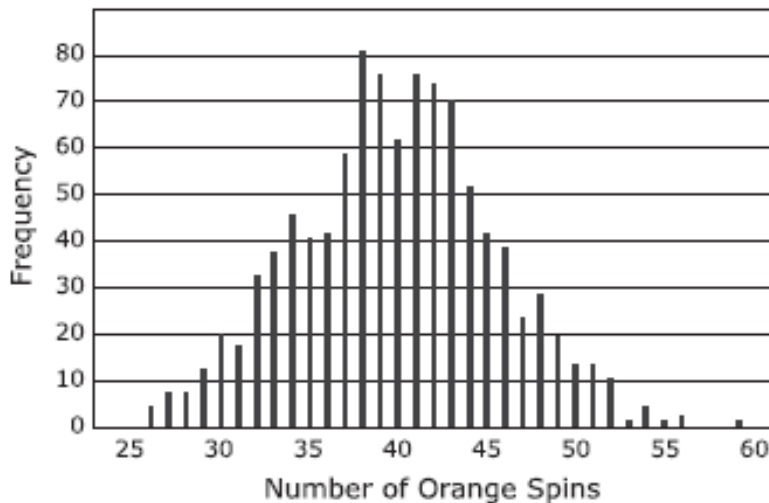
A) Yes, because 38 was the most frequent outcome.
B) Yes, because about 8°/o of the outcomes were 38.
C) No, because the distribution is approximately normal.
D) No, because an outcome of 38 or less is not unusual.

**51)** Write the point(s) of intersection for $y = 1 - x^2$ and $y = 2 + x$.

**52)** Write the point(s) of intersection for $f(x) = 2^x$ and $g(x) = \left(\dfrac{1}{2}\right)^x$.

**53)** Determine the solution(s) of the equation. Select **ALL** that apply.  $\dfrac{2m^2 + 3m - 5}{m^2 + 4m - 5} = 4$

     A) -5       B) $\dfrac{-15}{2}$       C) $\dfrac{-5}{2}$       D) 0       E) 1

**54)** A reporter wants to know the percentage of voters in the state who support building a new highway. What is the reporter's population?

A) the number of people who live in the state
B) the people who were interviewed in the state
C) all voters over 25 years old in the state
D) all eligible voters in the state

Reference : https://www.google.com/search?q=even+odd+functions&ie=utf-8&oe=utf-8#q=population+sample

**55)** In a set of test scores that are normally distributed, a test score of 76 is 3 standard deviations below the mean. A score of 88 is 1 standard deviation above the mean. What is the mean of the data?

     A) 79       B) 82       C) 84       D) 85

**56)** Which function is represented by the graph?
Each "hashmark" represents one unit.

     A) $y = e^x - 2$       B) $y = e^x + 2$

     C) $y = 2 - e^x$       D) $y = -2 - e^x$
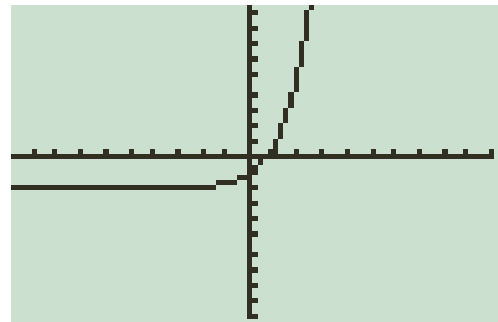
**57)** A study is done to determine which steroid cream is more effective for bug bites. If the only bug bites treated in this study were mosquito bites, which of the following is true?

A) The steroid cream that is found to be the best will work for all bug bites.
B) The steroid cream that is found to be the best will work only for mosquito bites.
C) The study will only be able to produce results concerning the effect of the steroid creams on mosquito bites.
D) The observational study is inherently biased.

**58)** The functions $f$ and $g$ are defined by $(x) = x^2$ and $(x) = 2x$, respectively. Which equation is equivalent to $h(x) = \dfrac{f(2x)g(-2x)}{2}$

    A. $h(x) = -2x^3$          B. $h(x) = -8x^3$      C. $h(x) = x^2 - 2x$     D. $h(x) = 2x^2 + 2x$

**59)** The expression $x^2(x - y)^3 - y^2(x - y)^3$ can be written in the form $(x - y)^a(x + y)$, where $a$ is a constant. What is the value of $a$?

**60)** A grocery store manager wants to determine how many servings of fresh fruit her adult customers eat per day. She randomly surveys adult customers in the produce aisle of her store about their eating habits. Which statement best explains why her survey could be biased?

    A) The sample does not include children.
    B) The produce aisle contains more than just fresh fruit.
    C) Adults who do not eat fresh fruit are less likely to shop in a local grocery store.
    D) Adults who do not eat fresh fruit are less likely to be found in the produce aisle.

**61)** The two-way table shows the classification of students in a mathematics class by gender and dominant hand. A student who is ambidextrous uses both hands equally well.

|  | Right-handed | Left-handed | Ambidextrous | Total |
|---|---|---|---|---|
| Male | 11 | 4 | 1 | 16 |
| Female | 12 | 2 | 0 | 14 |
| Total | 23 | 6 | 1 | 30 |

**Part A**
What is the probability that a randomly selected student in the class is female given that the student is right handed?

    A) $\dfrac{1}{12}$        B) $\dfrac{12}{30}$        C) $\dfrac{12}{23}$        D) $\dfrac{23}{30}$

**Part B**
One student will be selected at random from the class. Consider the events:
☐ X the selected student is female
☐ Y the selected student is right-handed

Which statement about events X and Y is true?
A. The events are independent because the number of right-handed students in the class is larger than the number of female students.
B. The events are independent because the number of categories for dominant hand is different from the number of categories for gender.
C. The events are not independent because for one of the dominant hand categories the number of female students is 0.
D. The events are not independent because the probability of X is not equal to the probability of X given Y.

**62)** The period for a pendulum to complete one swing is $t$, the time in seconds. The period can be approximated by the formula $t = 2\pi\sqrt{\dfrac{l}{9.81}}$ , where $l$ is the length of the pendulum in meters. If the period of a pendulum is 2.5 seconds, which is closest to the length of the pendulum?

A) 1.55 meters        B) 3.17 meters        C) 3.90 meters        D) 9.76 meters

**63)** The apparent position of a moon varies sinusoidally with the changing angle from a line of sight as it orbits Jupiter.  The moon's apparent position is shown in the graph below.  Which are the closest amplitude and period of the moon's orbit?



**Moon's Apparent Position**
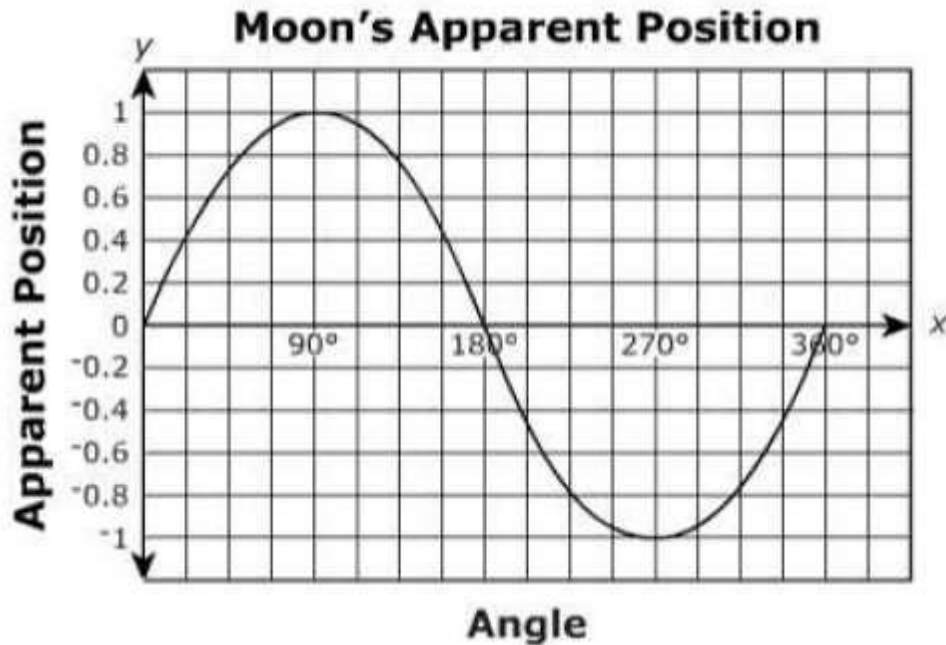
A) Amplitude = 0.5 and Period = 180°
B) Amplitude = 0.5 and Period = 360°
C) Amplitude = 1 and Period = 180°
D) Amplitude = 1 and Period = 360°

Hint :
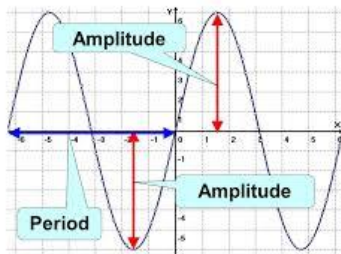


Sinusoid : a curve described by the equation y = a sin x, the ordinate being proportional to the sine of the abscissa.

**64)** Olivia selects marbles from a bag containing 5 red and 7 blue marbles. Which of the following events are independent?

A) selecting two red marbles in one pick
B) selecting a red and blue marble in one pick
C) selecting one red and one blue in two picks with replacement
D) selecting one red and one blue in two picks without replacement

**65)** Which degree measure is equivalent to $\dfrac{11\pi}{18}$ ?

     A)  220⁰     B)  110⁰     C) 55⁰     D) 10⁰

References :  https://www.youtube.com/watch?v=cgPYLJ-s5II
https://www.youtube.com/watch?v=HACNCy0clOo
https://www.youtube.com/watch?v=AMWLONeZmbo