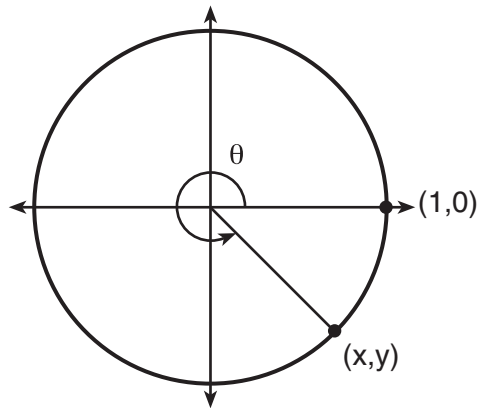Algebra 2 Regents problems
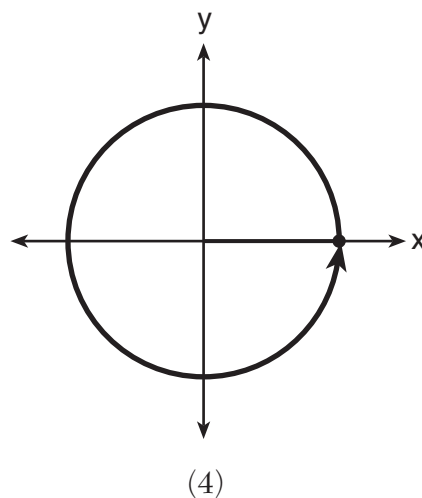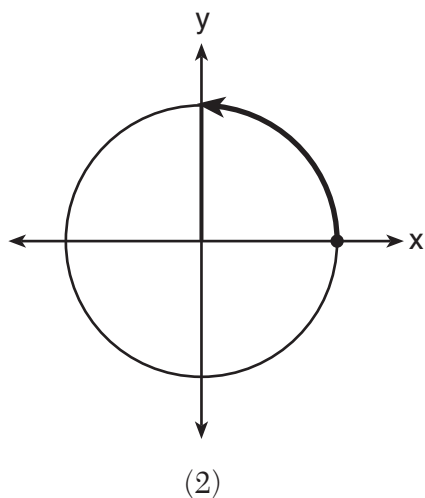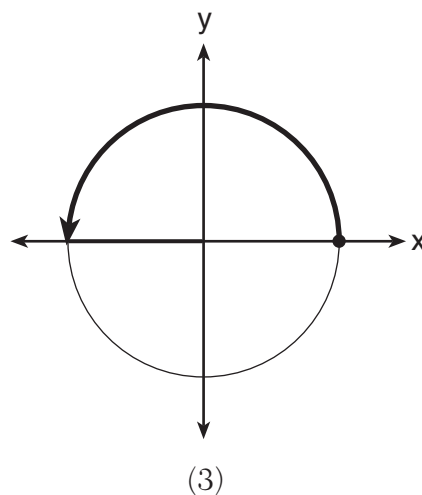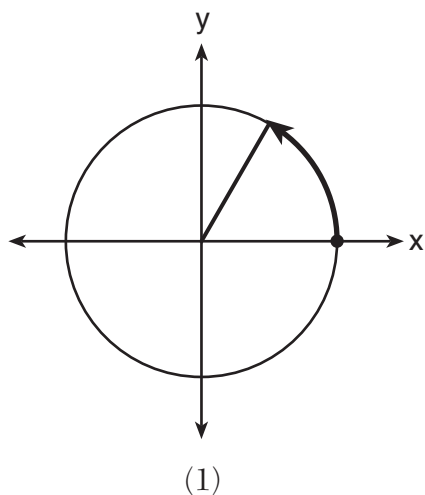
Jan 2017

27 Using the unit circle below, explain why $\csc\theta = \dfrac{1}{y}$.

28 Using the identity $\sin^2\theta + \cos^2\theta = 1$, find the value of $\tan\theta$, to the *nearest hundredth*, if $\cos\theta$ is -0.7 and θ is in Quadrant II.

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

(1)

(3)

(2)

(4)

17 A circle centered at the origin has a radius of 10 units. The terminal side of an angle, θ, intercepts the circle in Quadrant II at point C. The y-coordinate of point C is 8. What is the value of $\cos \theta$?

(1) $-\dfrac{3}{5}$ (3) $\dfrac{3}{5}$
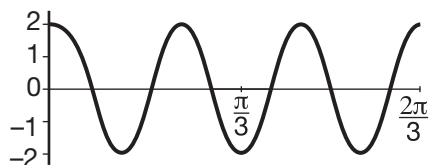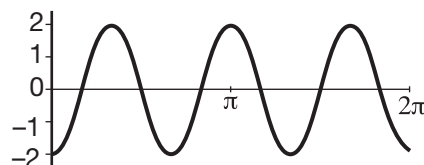
(2) $-\dfrac{3}{4}$ (4) $\dfrac{4}{5}$

16. A circle centered at the origin has a radius of 10 units. The terminal side of an angle,   , intercepts the circle in Quadrant II at point C. The y-coordinate of point C is 8. What is the value of $\cos$?
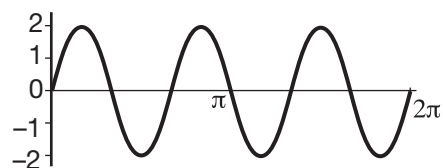
(1)   35 (3) 53 (2)   43 (4) 45

22 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of $\frac{2\pi}{3}$?

(1)

$$\sum_{n=1}^{6} 8(1.10)^{n-1}$$

(3)

$$\frac{8 - 8(1.10)^6}{0.90}$$
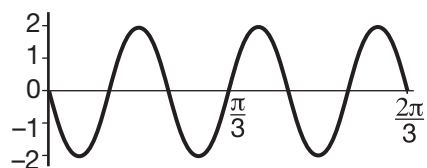
(2)

$$\sum_{n=1}^{6} 8(1.10)^n$$

(4)

$$\frac{8 - 8(0.10)^n}{1.10}$$

A sine function increasing through the origin can be used to model light waves. Violet light has a wavelength of 400 nanometers. Over which interval is the height of the wave *decreasing*, only?

(1) (0, 200) (3) (200, 400)

(2) (100, 300) (4) (300, 400)

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

$x^3 + 2x$ ... $x + 2$

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

$\frac{4}{x+2}$ $\frac{4}{x+2}$

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

7 The set of data in the table below shows the results of a survey on the number of messages that people of different ages text on their cell phones each month.

Age Group	Text Messages per Month		
	0–10	11–50	Over 50
15–18	4	37	68
19–22	6	25	87
23–60	25	47	157

If a person from this survey is selected at random, what is the probability that the person texts over 50 messages per month given that the person is between the ages of 23 and 60?
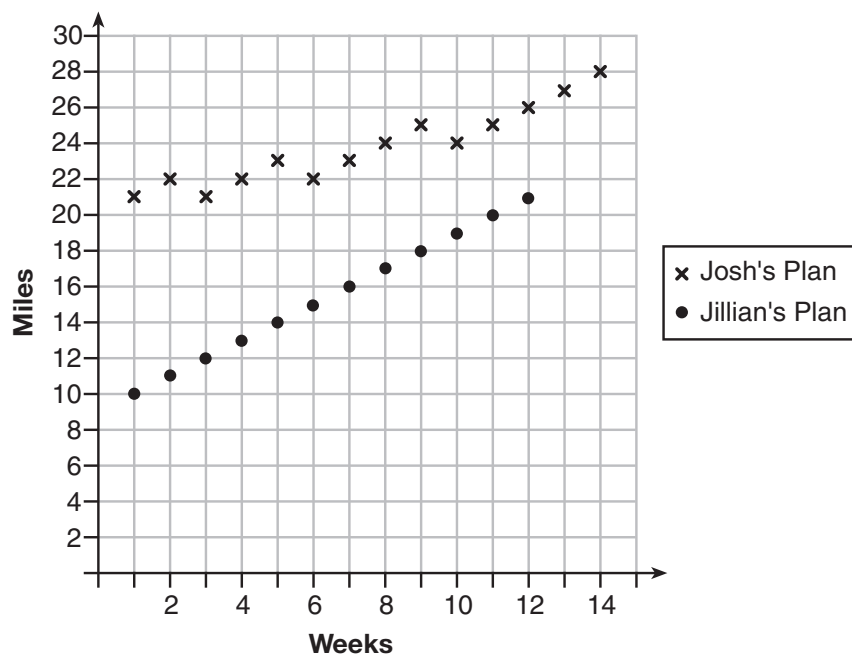
(1) $\dfrac{157}{229}$

(3) $\dfrac{157}{384}$

(2) $\dfrac{157}{312}$

(4) $\dfrac{157}{456}$

$\dfrac{1}{2}$

$\left(\dfrac{1}{2}\right)$

34 Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian's 12-week plan and Josh's 14-week plan. The number of miles run per week for each plan is plotted below.

Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer.

Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose.

Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.

$$\frac{157}{312}$$

$$\frac{1}{J} + \frac{1}{W} \quad \frac{\frac{157}{456}}{F}$$

8 A recursive formula for the sequence 18, 9, 4.5, ... is

(1) $g_1 = 18$

(3) $g_1 = 18$

$g_n = \frac{1}{2}g_{n-1}$

$g_n = 2g_{n-1}$

(2) $g_n = 18\left(\frac{1}{2}\right)^{n-1}$

(4) $g_n = 18(2)^{n-1}$

18 The sequence $a_1 = 6$, $a_n = 3a_{n-1}$ can also be written as

(1) $a_n = 6 \cdot 3^n$

(3) $a_n = 2 \cdot 3^n$

(2) $a_n = 6 \cdot 3^{n+1}$

(4) $a_n = 2 \cdot 3^{n+1}$

10 The formula below can be used to model which scenario?

$$a_1 = 3000$$

$$a_n = 0.80a_{n-1}$$

(1) The first row of a stadium has 3000 seats, and each row thereafter has 80 more seats than the row in front of it.

(2) The last row of a stadium has 3000 seats, and each row before it has 80 fewer seats than the row behind it.

(3) A bank account starts with a deposit of $3000, and each year it grows by 80%.

(4) The initial value of a specialty toy is $3000, and its value each of the following years is 20% less.

Kristin wants to increase her running endurance. According to experts, a gradual mileage increase of 10% per week can reduce the risk of injury. If Kristin runs 8 miles in week one, which expression can help her find the total number of miles she will have run over the course of her 6-week training program?
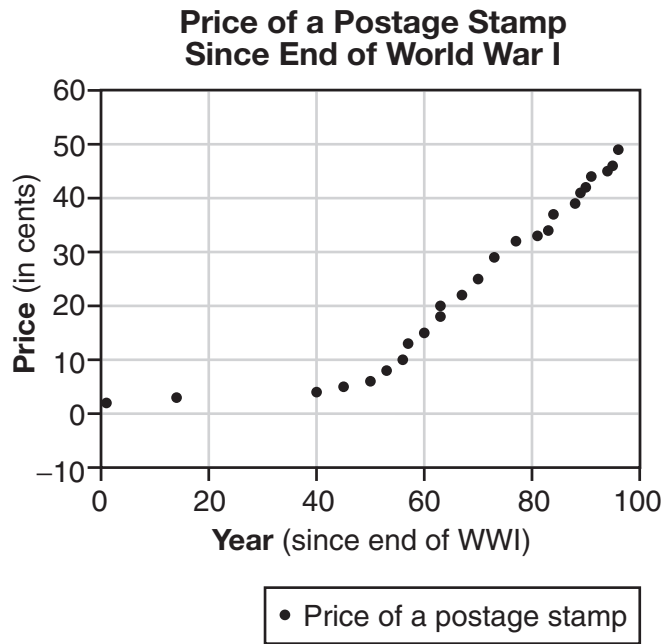
(1) $\displaystyle\sum_{n=1}^{6} 8(1.10)^{n-1}$

(3) $\dfrac{8 - 8(1.10)^6}{0.90}$

(2) $\displaystyle\sum_{n=1}^{6} 8(1.10)^{n}$

(4) $\dfrac{8 - 8(0.10)^{n-1}}{1.10}$

13 The price of a postage stamp in the years since the end of World War I is shown in the scatterplot below.

**Price of a Postage Stamp
Since End of World War I**

• Price of a postage stamp

The equation that best models the price, in cents, of a postage stamp based on these data is
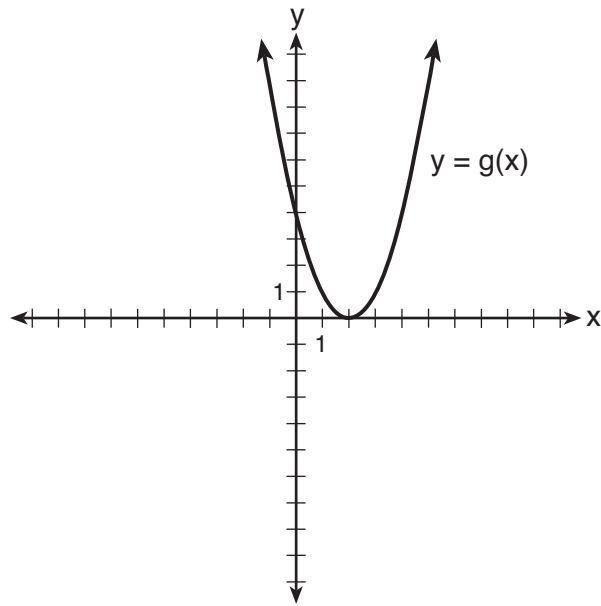
(1) $y = 0.59x - 14.82$
(2) $y = 1.04(1.43)^x$
(3) $y = 1.43(1.04)^x$
(4) $y = 24\sin(14x) + 25$

5 What is the solution to the system of equations $y = 3x - 2$ and $y = g(x)$ where $g(x)$ is defined by the function below?

(1) $\{(0,-2)\}$

(2) $\{(0,-2),(1,6)\}$

(3) $\{(1,6)\}$

(4) $\{(1,1),(6,16)\}$

2 Which statement(s) about statistical studies is true?

I. A survey of all English classes in a high school would be a good sample to determine the number of hours students throughout the school spend studying.

II. A survey of all ninth graders in a high school would be a good sample to determine the number of student parking spaces needed at that high school.

III. A survey of all students in one lunch period in a high school would be a good sample to determine the number of hours adults spend on social media websites.

IV. A survey of all Calculus students in a high school would be a good sample to determine the number of students throughout the school who don't like math.

(1) I, only

(2) II, only

(3) I and III

(4) III and IV

18 In 2013, approximately 1.6 million students took the Critical Reading portion of the SAT exam. The mean score, the modal score, and the standard deviation were calculated to be 496, 430, and 115, respectively. Which interval reflects 95% of the Critical Reading scores?

(1) 430 ± 115 (3) 496 ± 115

(2) 430 ± 230 (4) 496 ± 230

9 Gabriel performed an experiment to see if planting 13 tomato plants in black plastic mulch leads to larger tomatoes than if 13 plants are planted without mulch. He observed that the average weight of the tomatoes from tomato plants grown in black plastic mulch was 5 ounces greater than those from the plants planted without mulch. To determine if the observed difference is statistically significant, he rerandomized the tomato groups 100 times to study these random differences in the mean weights. The output of his simulation is summarized in the dotplot below.

Differences in Mean Weight (oz.)
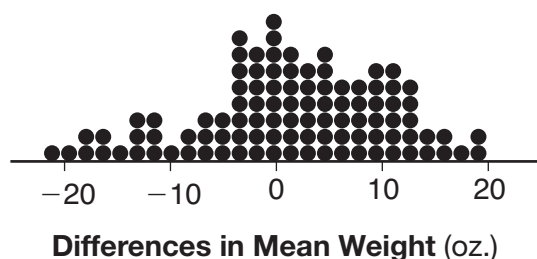
Given these results, what is an appropriate inference that can be drawn?

(1) There was no effect observed between the two groups.

(2) There was an effect observed that could be due to the random assignment of plants to the groups.

(3) There is strong evidence to support the hypothesis that tomatoes from plants planted in black plastic mulch are larger than those planted without mulch.

(4) There is strong evidence to support the hypothesis that tomatoes from plants planted without mulch are larger than those planted in black plastic mulch.

29 Elizabeth waited for 6 minutes at the drive thru at her favorite fast-food restaurant the last time she visited. She was upset about having to wait that long and notified the manager. The manager assured her that her experience was very unusual and that it would not happen again.

A study of customers commissioned by this restaurant found an approximately normal distribution of results. The mean wait time was 226 seconds and the standard deviation was 38 seconds. Given these data, and using a 95% level of confidence, was Elizabeth's wait time unusual? Justify your answer.

12 A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The output of the simulation is shown in the diagram below.
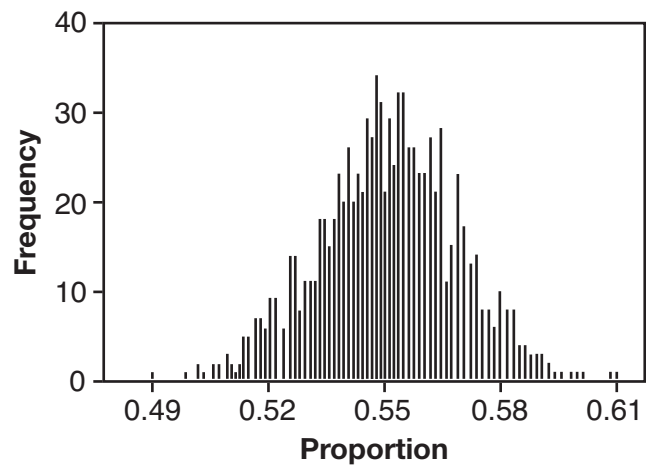
Given this output, and assuming a 95% confidence level, the margin of error for the poll is closest to

(1) 0.01   (3) 0.06

(2) 0.03   (4) 0.12

31 The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

Speed (mph)	10	20	30	40	50	60	70
Distance (ft)	6.25	25	56.25	100	156.25	225	306.25

Determine the average rate of change in braking distance, in ft/mph, between one car traveling at 50 mph and one traveling at 70 mph.

Explain what this rate of change means as it relates to braking distance.

36 Ayva designed an experiment to determine the effect of a new energy drink on a group of 20 volunteer students. Ten students were randomly selected to form group 1 while the remaining 10 made up group 2. Each student in group 1 drank one energy drink, and each student in group 2 drank one cola drink. Ten minutes later, their times were recorded for reading the same paragraph of a novel. The results of the experiment are shown below.

Group 1 (seconds)	Group 2 (seconds)
17.4	23.3
18.1	18.8
18.2	22.1
19.6	12.7
18.6	16.9
16.2	24.4
16.1	21.2
15.3	21.2
17.8	16.3
19.7	14.5
Mean = 17.7	Mean = 19.1

a) Ayva thinks drinking energy drinks makes students read faster. Using information from the experimental design or the results, explain why Ayva's hypothesis may be *incorrect*.

Using the given results, Ayva randomly mixes the 20 reading times, splits them into two groups of 10, and simulates the difference of the means 232 times.

Simulated Differences

Differences (Group 1 – Group 2)
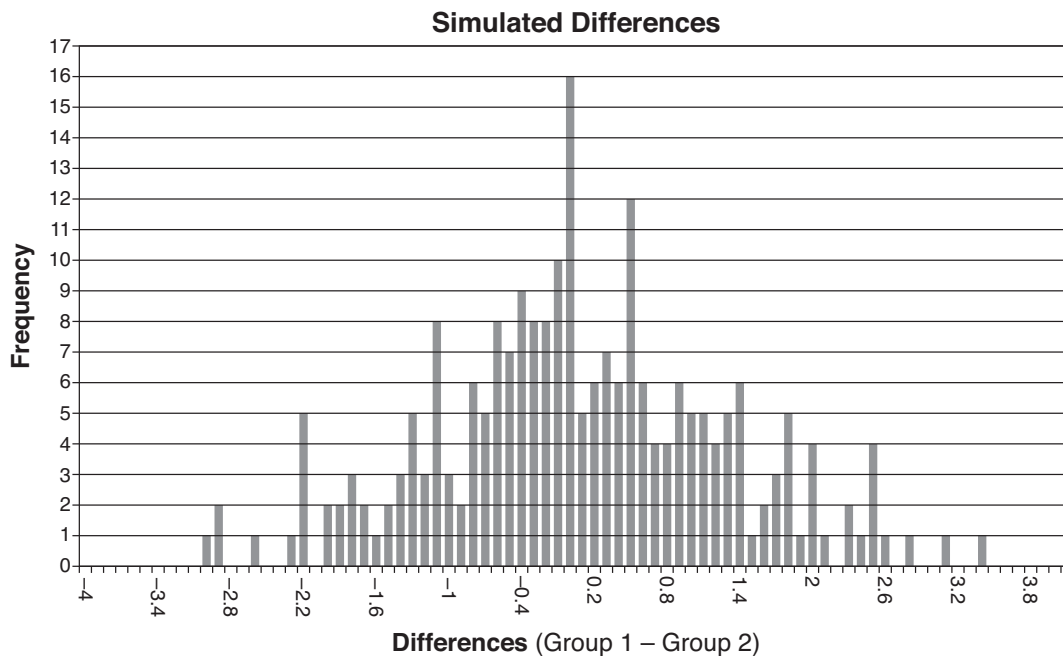
b) Ayva has decided that the difference in mean reading times is *not* an unusual occurence. Support her decision using the results of the simulation. Explain your reasoning.

36 Which function shown below has a greater average rate of change on the interval $[-2, 4]$? Justify your answer.

x	f(x)
−4	0.3125
−3	0.625
−2	1.25
−1	2.5
0	5
1	10
2	20
3	40
4	80
5	160
6	320

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

35 Fifty-five students attending the prom were randomly selected to participate in a survey about the music choice at the prom. Sixty percent responded that a DJ would be preferred over a band. Members of the prom committee thought that the vote would have 50% for the DJ and 50% for the band.

A simulation was run 200 times, each of sample size 55, based on the premise that 60% of the students would prefer a DJ. The approximate normal simulation results are shown below.
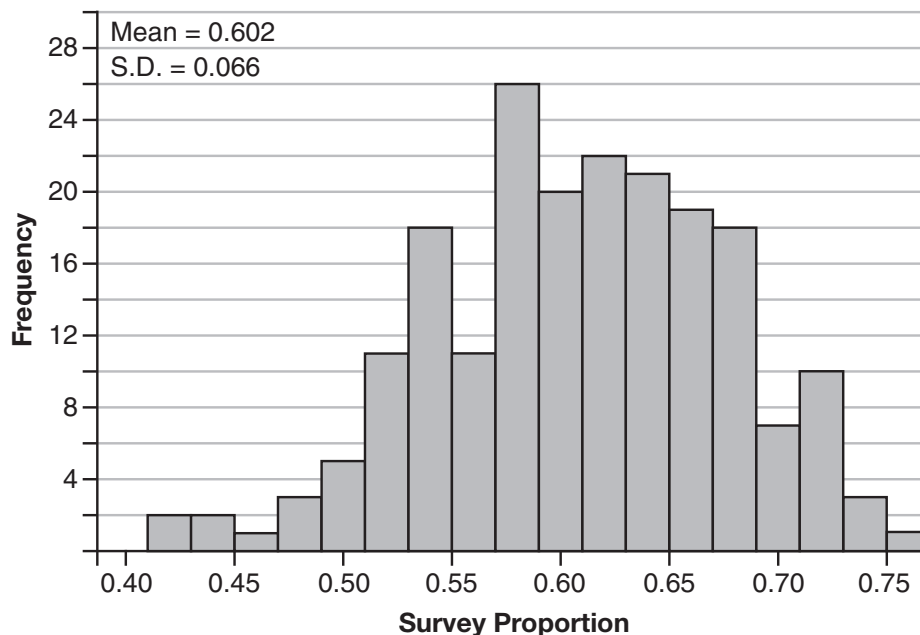
Using the results of the simulation, determine a plausible interval containing the middle 95% of the data. Round all values to the *nearest hundredth*.

Members of the prom committee are concerned that a vote of all students attending the prom may produce a 50% – 50% split. Explain what statistical evidence supports this concern.

7 Anne has a coin. She does not know if it is a fair coin. She flipped the coin 100 times and obtained 73 heads and 27 tails. She ran a computer simulation of 200 samples of 100 fair coin flips. The output of the proportion of heads is shown below.
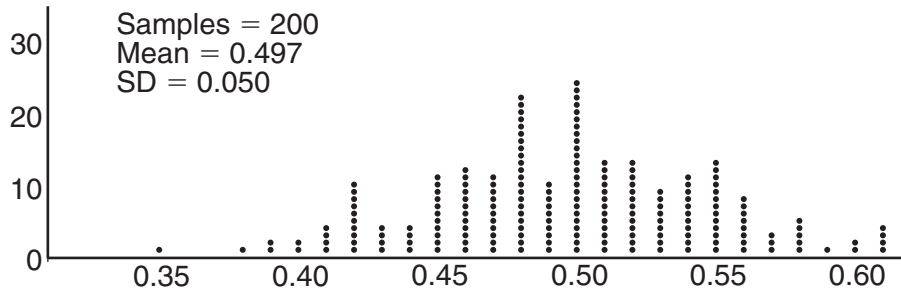
Given the results of her coin flips and of her computer simulation, which statement is most accurate?

(1) 73 of the computer's next 100 coin flips will be heads.

(2) 50 of her next 100 coin flips will be heads.

(3) Her coin is not fair.

(4) Her coin is fair.

$$\frac{m(c)}{g(c)} = \frac{-1}{1-c}$$

20 There was a study done on oxygen consumption of snails as a function of pH, and the result was a degree 4 polynomial function whose graph is shown below.
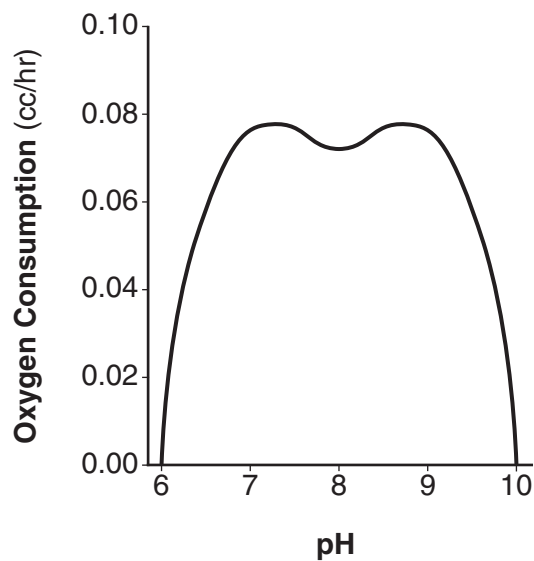
Which statement about this function is *incorrect*?

(1) The degree of the polynomial is even.

(2) There is a positive leading coefficient.

(3) At two pH values, there is a relative maximum value.

(4) There are two intervals where the function is decreasing.

$$(1.0525)^{\frac{12}{m}}$$
$$(1.00427)^{\frac{m}{12}}$$