

TEST 1

Part I

- | | | | | | |
|------|------|-------|-------|-------|-------|
| 1. 1 | 5. 2 | 9. 1 | 13. 3 | 17. 4 | 21. 2 |
| 2. 1 | 6. 2 | 10. 2 | 14. 1 | 18. 1 | 22. 4 |
| 3. 1 | 7. 1 | 11. 2 | 15. 3 | 19. 4 | 23. 2 |
| 4. 2 | 8. 4 | 12. 4 | 16. 3 | 20. 4 | 24. 3 |

For parts II, III, and IV, answers may vary, partial credit should be given for answers that include, but not limited to, the following:

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- incorrect answer, but rest of work is appropriate
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Part II

25. \$1519
26. 6 seconds $-16t^2 + 64t + 192 = 0$
 $t^2 - 4t - 12 = 0$
 $(t - 6)(t + 2) = 0$
 $t = 6$ or $t = -2$

t cannot equal -2 because a negative time is not possible.

6 seconds after it is thrown, the water balloon will hit the ground.

27.

x	y (actual)	y (predicted)
0	5	6
1	10	10
2	21	19
3	38	34
4	85	62
5	50	113
6	302	208

The point (5, 50) is well below the exponential curve. The rest of the points form an exponential curve, but this outlier impacts the regression.

28. The domain is $[0, 500]$ or $\{n | 0 \leq n \leq 500\}$
 The range is $[0, 1875]$ or $\{c | 0 \leq c \leq 1875\}$
29. Answers may vary. This would decrease the chance that there is a significant difference between the two groups. The larger standard deviation means the scores in the experimental group are more variable. Therefore it is more likely that the difference could have been due to chance.
30. Simplest radical form: $\sqrt{5} + 5$ by $\sqrt{5}$ by $\sqrt{5} - 1$
 Nearest hundredth: 7.24 by 2.24 by 1.24
31. a) Decay. The base is less than 1.
 b) A_0 , the starting amount is 280. Kira borrowed \$280 from her grandmother.
 c) $1 - 0.88 = 0.12$
 The percent change is 12%.
 Kira pays 12% of the loan back to her grandmother each year.

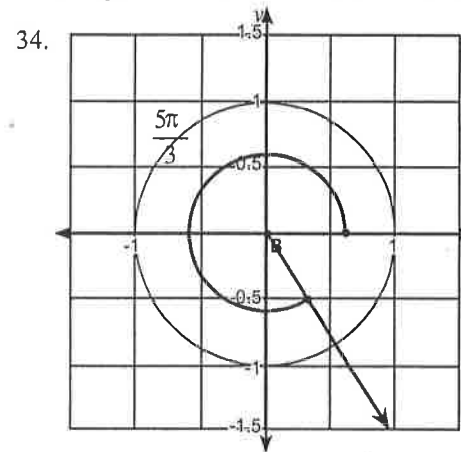
32. $x = \frac{7}{2}$ Answers will vary.
 A correct explanation of each step in solving the equation.

Part III

33. $y = 26.02\sin(.49x - 1.86) + 58.85$

73 degrees

1 degree below the actual value in the table



$(\frac{1}{2}, -\frac{\sqrt{3}}{2})$

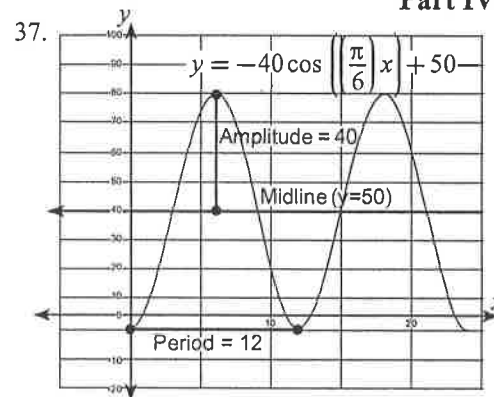
Answers vary. Example: $-\frac{\pi}{3}$

35. $\frac{63}{110}$ $\frac{1}{110}$ $\frac{48}{110}$ $\frac{37}{39}$

36. $x^2 + 5x + 4 + \frac{-5}{x+2}$

No, $x + 2$ is not a factor because there is a remainder of -5 .
 If $x + 2$ were a factor, then there would be a remainder of 0.

Part IV



The period is 12 months. The cycle of temperatures repeats every year.

The midline is 50 degrees which is the "middle value" between the high and low temperatures during the year.

The amplitude is 40 which means the temperature fluctuates 40 degrees from the midline value of 50 degrees.

TEST 2

Part I

- | | | | | | |
|------|------|-------|-------|-------|-------|
| 1. 3 | 5. 2 | 9. 4 | 13. 2 | 17. 3 | 21. 4 |
| 2. 3 | 6. 4 | 10. 1 | 14. 1 | 18. 3 | 22. 1 |
| 3. 1 | 7. 1 | 11. 3 | 15. 1 | 19. 3 | 23. 3 |
| 4. 3 | 8. 1 | 12. 2 | 16. 1 | 20. 2 | 24. 2 |

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Part II

25. $-3(-5 - 2i) + 8i(-5 - 2i)$ distributive property
 $15 + 6i - 40i - 16i^2$ distributive property
 $15 + 6i - 40i + 16$ $i^2 = -1$
 $15 + 16 + 6i - 40i$ commutative property
 $31 - 34i$

26. $h^{-1}(x) = \frac{\ln\left(\frac{x}{12}\right)}{2}$
 $\frac{\ln\left(\frac{10}{12}\right)}{2}$ or an equivalent answer

27. $y = 5000(.8)^x$

28. Answers will vary. Correct explanation. Possible Answer:

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

$$\frac{3}{4} \log 2 = \frac{1}{4} \log 2$$

29. Give the survey to every third person entering the building instead of a cluster of people at one location (the dance).

Give the survey to at least 10% of the high school population.

30. x -intercept is $(-2, 0)$
 y -intercept is $(0, -\frac{2}{3})$
 asymptotes $x = -3$ and $x = 1$
 $y = 0$

31. The y -intercept is at $(0, 4)$. There is no x -intercept.
 As $x \rightarrow -\infty, y \rightarrow \infty$, and the graph is rising.
 As $x \rightarrow \infty, y \rightarrow 3$, and the graph is falling.

32. All values of k where k is greater than 9.

When $b^2 - 4ac < 0$, the roots of the equation are complex.

$$(-6)^2 - 4(1)k < 0$$

$$36 - 4k < 0$$

$$-4k < -36$$

$$k > 9$$

Part III

33. Average: .65

Standard Deviation: .07

Margin of Error: .65 + or -.14

This result could have happened by chance. A sample proportion of .73 is within the confidence interval of .51 - .79.

34. $A(x) = 2x + 12$

$$B(x) = 1.5x + 16$$

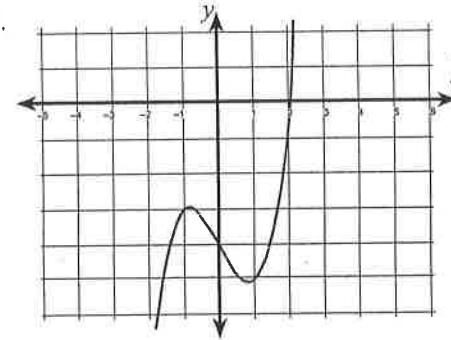
8 rides

Carnival A would have the lower cost for five rides. Carnival A would cost \$22 and Carnival B would cost \$23.50 for five rides.

$$A(5) = 2(5) + 12 = 22$$

$$B(5) = 1.5(5) + 16 = 23.5$$

35.



$$f(2) = 0$$

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

$$-1 + i \text{ and } -1 - i$$

36. 8, 15, 17

$$\left(\frac{8}{17}\right)^2 + \left(\frac{15}{17}\right)^2 = 1$$

$$\left(\frac{64}{289}\right) + \left(\frac{225}{289}\right) = 1$$

$$\frac{289}{289} = 1$$

$$1 = 1$$

TEST 3

Part I

- | | | | | | |
|------|------|-------|-------|-------|-------|
| 1. 4 | 5. 4 | 9. 2 | 13. 4 | 17. 3 | 21. 1 |
| 2. 4 | 6. 3 | 10. 4 | 14. 2 | 18. 2 | 22. 1 |
| 3. 2 | 7. 3 | 11. 3 | 15. 2 | 19. 2 | 23. 1 |
| 4. 2 | 8. 1 | 12. 4 | 16. 3 | 20. 1 | 24. 4 |

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Part II

25. $d(x) = 580 - 60x$

26. $-2x^2 - 5x - 1 + \frac{5x - 2}{4x^2 - 5x + 2}$

27. $(x - 1)(3x - 2)(x + 4)$ $3x^3 + 7x^2 - 18x + 8$ divided by $x - 1$ is $3x^2 + 10x - 8$ which can be factored into $(3x - 2)(x + 4)$

28. $\left\{-1 - \frac{\sqrt{3}}{2}i, -1 + \frac{\sqrt{3}}{2}i\right\}$

29. $\frac{16}{3}$ seconds

54 inches and 30 inches

30. $-22 + 14i$

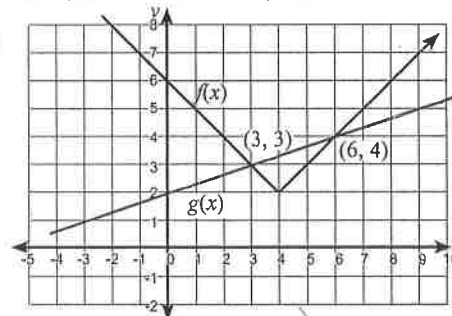
Part III

31. Yes, the average rate of change is constant. The average rate of change at every interval is 4 miles per hour.

	Basketball	Soccer	Track	Totals
Male	6	10	4	20
Female	10	15	5	30
Totals	16	25	9	50

$P(\text{BB}|\text{G}) = 10/30 = 1/3$; yes, female and soccer are independent.

33.

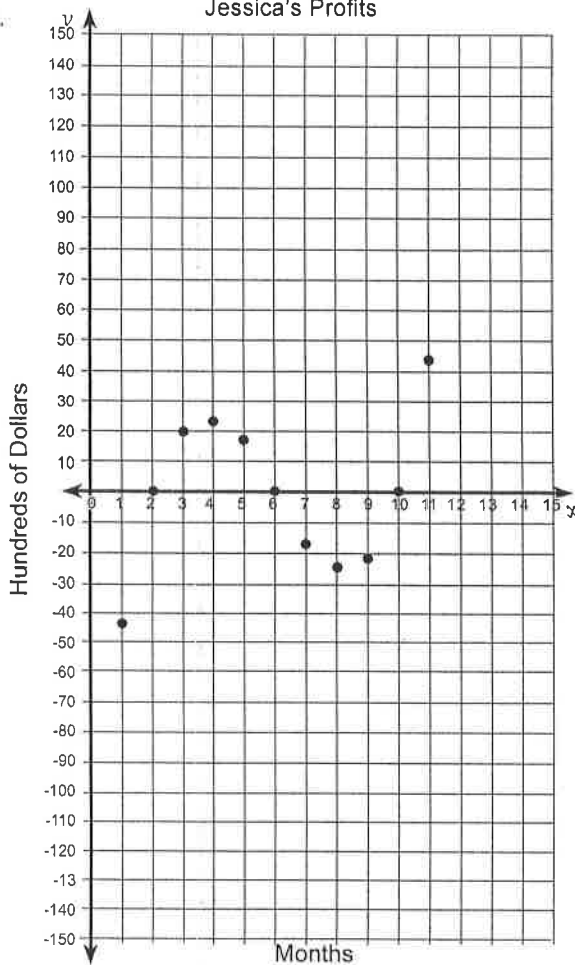


$(3, 3)$ and $(6, 4)$
 $x = 3$ and $x = 6$
 The solutions to the system of equations, $f(x)$ and $g(x)$ are the same as the quadrants of the intersection of the graph for $f(x)$ and $g(x)$.

Part IV

Jessica's Profits

37.



December

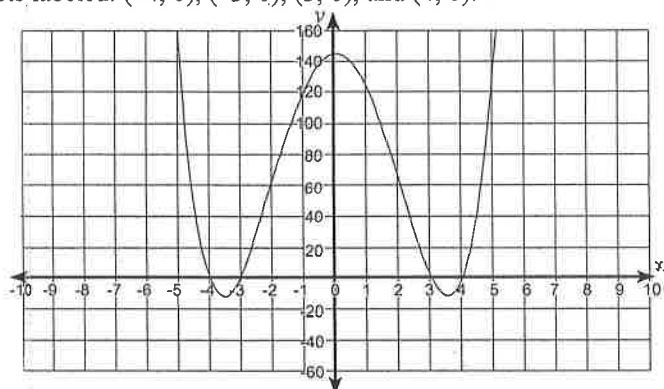
May, June, July, and August

No, explanations vary.

Example: The function increases too rapidly over this domain. For example, the value of $h(x)$ when $x = 20$ is 2,520. That would mean she made \$252,000. It is doubtful that her profits would increase that much in the second year.

34. $(x + 4)(x - 4)(x + 3)(x - 3)$

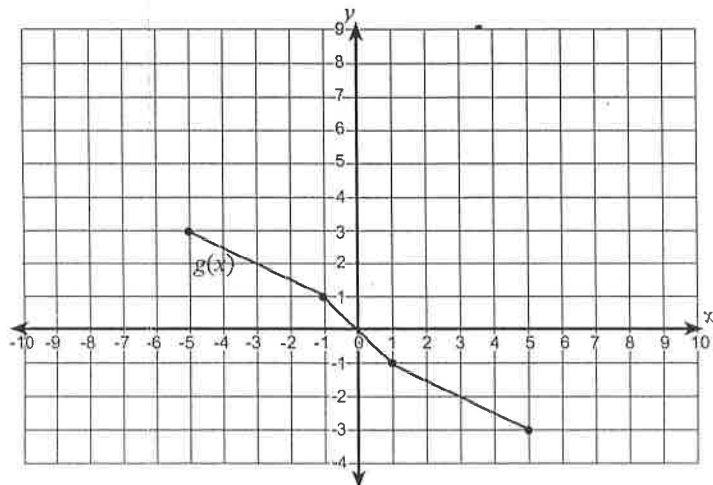
With x -intercepts labeled: $(-4, 0)$, $(-3, 0)$, $(3, 0)$, and $(4, 0)$.



Answers vary.

Example: If part a were set equal to zero, the solutions to the equation would be the same as the x values of the x -intercepts on the graph.

35.



The function is odd. It is symmetric about the origin.

36. y -intercept of $f(x)$: 10

zeros of $f(x)$: $-2, 1, 5$

Increasing

relative extrema: 2

Part IV

37. $y = 11.993x + 186.883$

The correlation coefficient is 0.978. There is a strong positive correlation. As the fat content increases, the calories increase.

The slope is 11.993. For each gram of fat, the calories increase by approximately 12.

307 Calories

TEST 4

Part I

- | | | | | | |
|------|------|-------|-------|-------|-------|
| 1. 2 | 5. 3 | 9. 2 | 13. 2 | 17. 1 | 21. 2 |
| 2. 2 | 6. 1 | 10. 2 | 14. 4 | 18. 1 | 22. 3 |
| 3. 3 | 7. 1 | 11. 1 | 15. 3 | 19. 1 | 23. 2 |
| 4. 4 | 8. 1 | 12. 2 | 16. 3 | 20. 1 | 24. 3 |

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Part II

25. $(-4, -3), (3, 4)$

26. Answers Vary: one example: $f(x) = -5 \cos\left[\frac{\pi}{5}(x-2)\right] + 9$

27. $d(x) = |300 - (50 + 20x)|$ or an equivalent function.

10, 15 Answers may vary. Example: the difference between the time it takes him to complete the job and three hours is 50 minutes.

28. Answers may vary:

- The voluntary response sample
- or The wording of the question
- or The small sample size

29. $x + 2$ is a factor of $p(x) = x^5 + 2x^4 - 3x^3 - 6x^2 - 6x - 12$.

The remainder is 0 when $x^5 + 2x^4 - 3x^3 - 6x^2 - 6x - 12$ is divided by $x + 2$.
or Since $p(-2) = 0$, $x + 2$ is a factor.

30. Explanations may vary. $x = \frac{1}{12}$

31.

Function	Base b	Growth or decay?	x -intercept	y -intercept	Increasing or decreasing?
$f(x) = 3^x$	3	growth	None	$(0, 1)$	Increasing
$g(x) = (0.87)^x$.87	decay	None	$(0, 1)$	Decreasing

32. $a^2 + b^2 = c^2$ $\sin \theta = \frac{y}{1} = y$

$x^2 + y^2 = 1$ $\cos \theta = \frac{x}{1} = x$

$\cos^2 x + \sin^2 x = 1$

Part III

33. $S_{30} = \frac{.5(1-1.1^{30})}{1-1.1} = 82.247$ mi

34. {5}

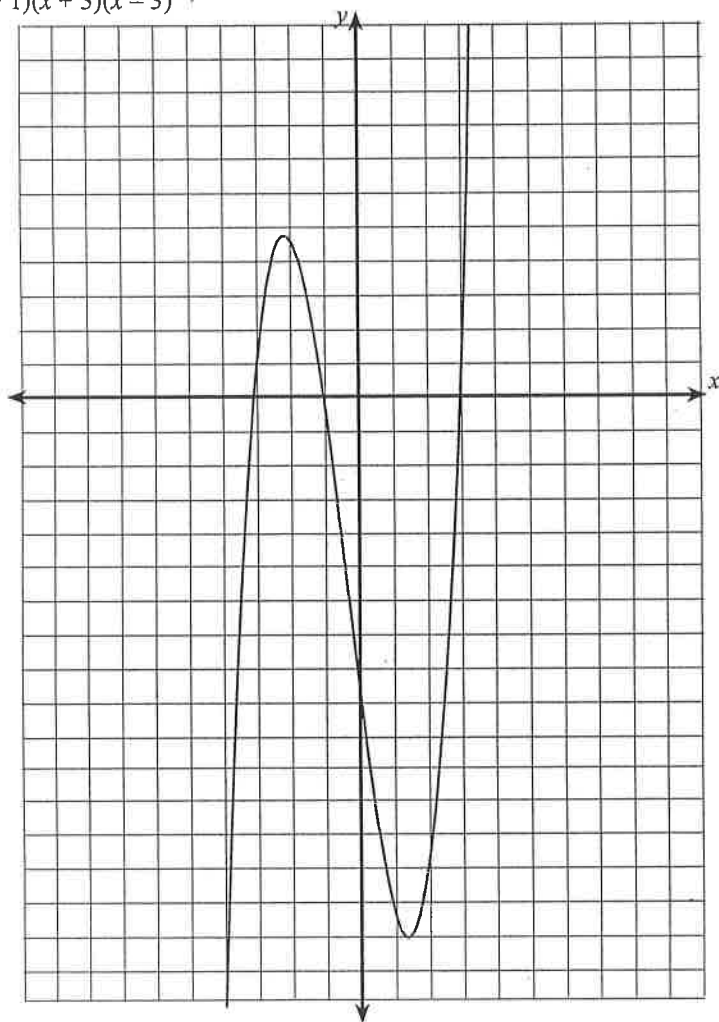
$x = 0$ is an extraneous solution that must be rejected. When 0 is substituted into the equation for x and both sides of the equation are simplified, the result is $1 = -1$ which is not a true statement. So $x = 5$ is the only solution to the equation.

35. $y = 3.17x - 55.80$

Corr. Coeff = .939

The correlation coefficient is .939. There is a strong positive correlation between the club head speed and the distance.

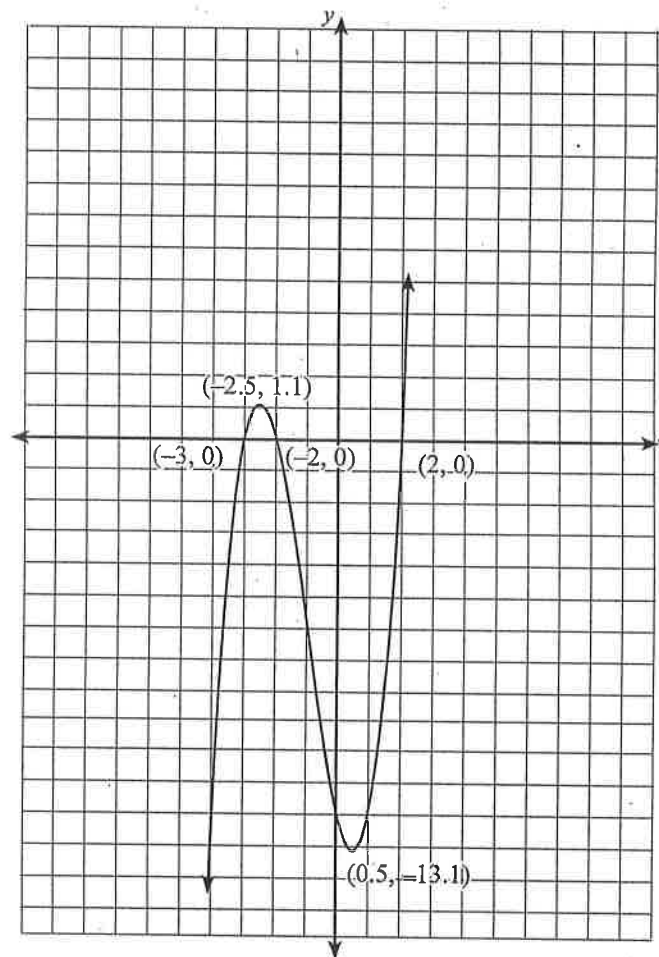
36. $(x + 1)(x + 3)(x - 3)$



Part IV

37. The factors of $p(x)$ are $(x + 2)(x - 2)(x + 3)$ because $p(-2)$, $p(2)$ and $p(-3)$ all result in 0.

Since the leading coefficient is greater than 0 and the degree of the polynomial is odd, the function will increase at the right end and decrease at the left end.



TEST 5

Part I

- | | | | | | |
|------|------|-------|-------|-------|-------|
| 1. 4 | 5. 2 | 9. 4 | 13. 4 | 17. 2 | 21. 4 |
| 2. 2 | 6. 3 | 10. 2 | 14. 1 | 18. 4 | 22. 3 |
| 3. 2 | 7. 3 | 11. 3 | 15. 3 | 19. 3 | 23. 3 |
| 4. 3 | 8. 4 | 12. 3 | 16. 2 | 20. 2 | 24. 1 |

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Part II

25. $-2 + 2i$
26. Example: Jennifer splits the athletes into a control group and an experimental group. The control group does not shoot before practice while the experimental group shoots 100 times before practice. Jennifer records the number of points made by athletes in each groups and compares the results from each group.
27. $y = 26,000(1.02)^t$
28. 46.7%
29. $m(x) = 35 + 5x + 20(13.75)(1.04)^x$
30. Yes, $x = 3$ is an extraneous solution. x cannot equal 3 because division by 0 is undefined.
31. $h^{-1}(x) = \frac{5x+4}{-x+1}$ or an equivalent answer

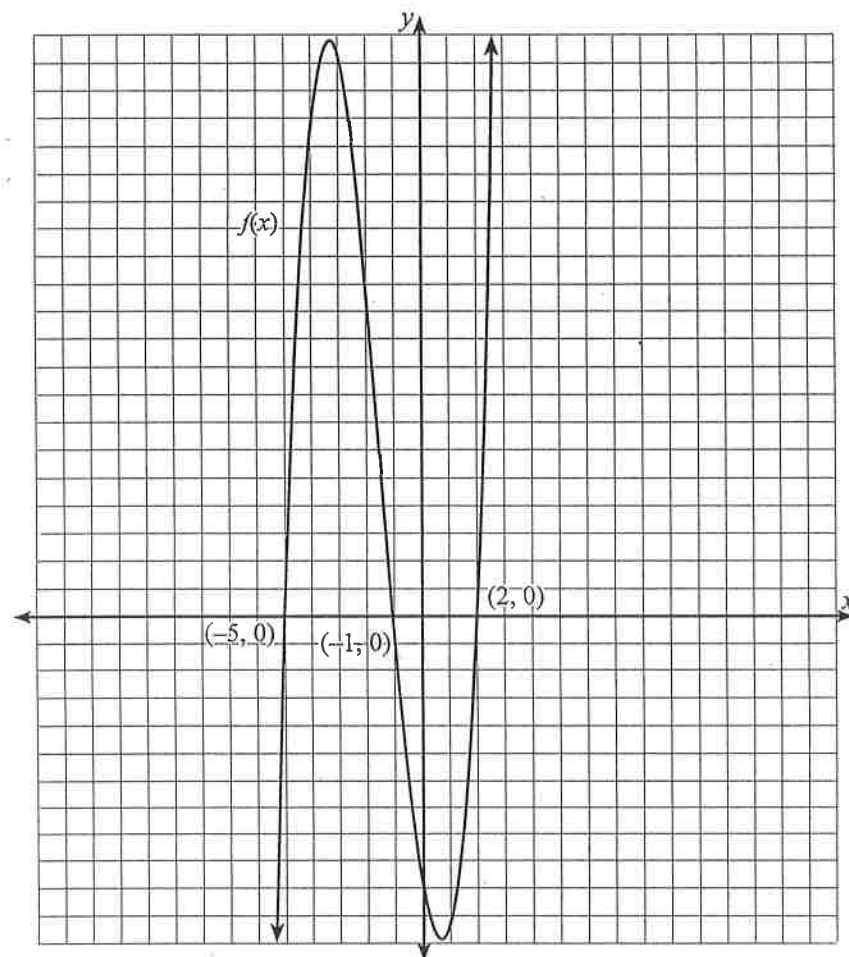
Part III

32. $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$
 The probability of this happening is $1/8$. They are independent because the product of there individual probabilities is the the probability of both occurring as described.
33. 0.172 dollars per year (or 17.222 cents per year)
 $y = 1.836(1.066)^x$
 0.169 dollars per (or 16.908 cents per year)
- Answers vary. For example, the first answer came from the actual data values, while the answer using the regression equation came from the exponential curve of best fit which may not go through some or all of the data points in the table.

34. Graph $f(x) = x^3 + 4x^2 - 7x - 10$ and label the roots.

Roots: $(2, 0)$, $(-1, 0)$ and $(-5, 0)$

Factored form: $f(x) = (x-2)(x+1)(x+5)$



35. $A_n = 12.50 + .50(n - 1)$

$$B_5 = 12.50(1.04)^{n-1}$$

$$B_5 = 12.50(1.04)^{5-1} = \$14.62$$

$$A_5 = 12.50 + .50(5 - 1) = \$14.50$$

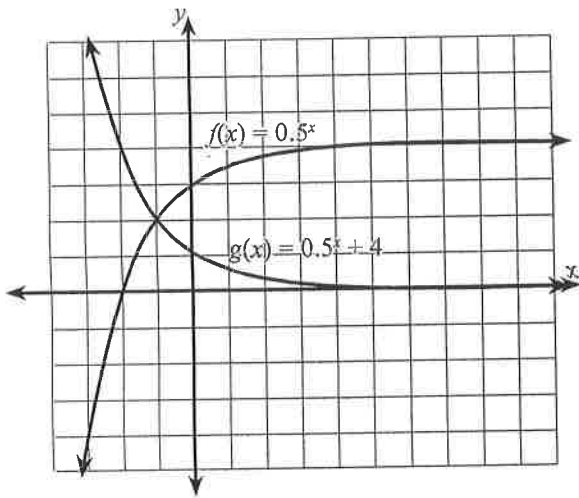
B_5 is the better formula as it results in the correct hourly rate.

36. $\{-3 - i, -3 + i\}$

Completing the square is a process which results in the quadratic formula. By assigning a as the coefficient of the squared term, b as the coefficient of the linear term, and c as the constant and solving for x in terms of a , b , and c , the quadratic formula is created.

Part IV

37.



$f(x)$ is reflected over the x -axis and then translated up 4 units to produce $g(x)$. The graph of $f(x)$ is rising on the left as $f(x) \rightarrow \infty$ and decreasing on the right as $f(x) \rightarrow 0$. The y intercept is at $y = 1$. The graph of $g(x)$ is decreasing on the left as $g(x) \rightarrow -\infty$ and rising on the right as $g(x) \rightarrow 4$. The y intercept is $y = 5$, and the x intercept is at $x = -2$.

TEST 6

Part I

- | | | | | | |
|------|------|-------|-------|-------|-------|
| 1. 1 | 5. 4 | 9. 3 | 13. 2 | 17. 1 | 21. 3 |
| 2. 1 | 6. 1 | 10. 4 | 14. 3 | 18. 1 | 22. 1 |
| 3. 2 | 7. 3 | 11. 1 | 15. 4 | 19. 2 | 23. 2 |
| 4. 1 | 8. 1 | 12. 2 | 16. 1 | 20. 2 | 24. 3 |

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Part II

25. $x = 2, y = -1, z = 1$

26. $p(x) = (x - 3)(x - 1)(x + 2)$
 $p(x) = x^3 - 2x^2 - 5x + 6$

27. $f(x) = (x - 1)(x - 2)(x - 3)$

28. $M(s) = 25 - 1.29s$

9 weeks

Answers will vary. Correct answer and correct explanation of how the correct answer was found.

Possible explanations: $0 = 25 - 1.29s$ or $-25/-1.29 = s$
or $s = 19.3798$ or $19.3798/2 = 9.6899$ or 9 weeks

Jerry could purchase two songs every week for 9 weeks using only his gift card. I set the equation equal to 0 and solved for s to determine how many songs he could purchase using his gift card. I found that Jerry could purchase 19 songs using his gift card. I divided 19 by 2 since he would be purchasing two songs a week. I found that if he purchases two songs a week, then he could purchase 18 songs over 9 weeks using only his gift card.

29. a) Using $P(B|A) = P(B)$ to determine whether the probability of each event is conditional or independent shows that the two probabilities are equal.

The probability that a randomly selected student who is male participates in a school sport is 25%. The probability that a randomly selected student participates in a school sport is 25%. Yes, they are independent because knowing that a randomly selected student is male does not change the probability that the selected student participates in a sport.

b) 75% of females do not participate in a school sport. This is a conditional probability because it is based on only the females.

30. $a_n = 18.5 + 1.5(n - 1)$ or an equivalent formula

The number of people who own a smartphone in 2019 is represented by a_5 .

Explicit: $a_n = 18.5 + 1.5(5 - 1) = 24.5$

$a_n = 18.5 + 1.5 = 20$

$a_n = 20 + 1.5 = 21.5$

Recursive: $a_n = 21.5 + 1.5 = 23$

$a_n = 23 + 1.5 = 24.5$

24.5 million people in the US will own smartphones in 2019.

31. Group A mean: 17.2 Group B mean: 18.3 Difference: 1.4

Answers vary. Example: I do not think the difference in sample means is significant. The absolute value of the 100 differences was greater than 1.6. Therefore the difference could have been due to chance.

or Example: Lincoln could use larger groups in his study. If he created two groups of 50 students, he would of had a better chance to find a significant difference.

32. period: 1.75

midline: 109

minimum value: 24 maximum value: 194

Inches. Example explanation: The bar would be about 109 inches off the ground. If it were 109 centimeters off the ground, this would be just over 3 feet. The gymnast would not have room to go around with arms extended. If it were 109 feet, there would be no way to get on the bar. In addition, the maximum and minimum values of 24 feet and 194 feet would mean that the distance from the gymnasts feet to hands on the bar would be 85 feet. This is also not reasonable.

Part III

33. $(x + 2)(x - 2)(x - 6)$

Set each factor equal to 0. Solve each equation to determine the solutions to the equation $x^3 - 6x^2 - 4x + 24 = 0$

$x + 2 = 0$ or $x - 2 = 0$ or $x - 6 = 0$

$x = -2$ $x = 2$ $x = 6$

$\{-2, 2, 6\}$

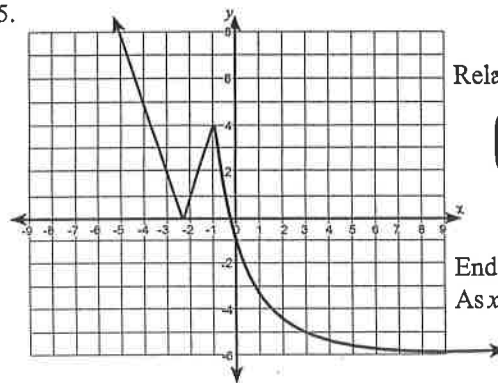
The x -intercepts of a function are the same as the solutions to the equation. The x -intercepts are found by replacing $f(x)$ with 0 and solving the equation because the output of the function must be 0 in order for the function to intersect the x -axis.

34. $x = 1.177$

17.7% increase

4,902 people per year

35.



Relative maximum: $x = -1$

$\left(-\infty, -\frac{7}{3}\right) \cup (-1, \infty)$

End behavior:

As x approaches ∞ , $p(x)$ approaches -6

36. $(x + y)(x + y)(x + y) = x^3 + 3x^2y + 3xy^2 + y^3$
 $(x + y)(x + xy + xy + y^2) = x^3 + 3x^2y + 3xy^2 + y^3$
 $(x + y)(x + 2xy + y^2) = x^3 + 3x^2y + 3xy^2 + y^3$
 $x^3 + 2x^2y + xy^2 + x^2y + 2xy^2 + y^3 = x^3 + 3x^2y + 3xy^2 + y^3$
 $x^3 + 3x^2y + 3xy^2 + y^3 = x^3 + 3x^2y + 3xy^2 + y^3$

and

$(2a)^3 + 3(2a^2)(-3) + 3(2a)(-3)^2 + (-3)^3$
 $8a^3 - 36a^2 + 54a - 27$

Part IV

37. $(-7)(3) = -21$

