

ALGEBRA 2

Workbook

Common Core Standards Edition

Published by
TOPICAL REVIEW BOOK COMPANY

P. O. Box 328
Onsted, MI 49265-0328
www.topicalrbc.com

<u>EXAM</u>	<u>PAGE</u>
Reference Sheet	<i>i</i>
Test 1	1
Test 2	11
Test 3	21
Test 4	31
Test 5	40
Test 6	48
Correlation of Standards	59



**Common Core High School Math Reference Sheet
(Algebra I, Geometry, Algebra II)**

CONVERSIONS

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilograms	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallon
		1 liter = 1000 cubic centimeters

FORMULAS

Triangle	$A = \frac{1}{2}bh$	Pythagorean Theorem	$a^2 + b^2 = c^2$
Parallelogram	$A = bh$	Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Circle	$A = \pi r^2$	Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Circle	$C = \pi d$ or $C = 2\pi r$	Geometric Sequence	$a_n = a_1 r^{n-1}$
General Prisms	$V = Bh$	Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Cylinder	$V = \pi r^2 h$	Radians	1 radian = $\frac{180}{\pi}$ degrees
Sphere	$V = \frac{4}{3}\pi r^3$	Degrees	1 degree = $\frac{\pi}{180}$ radians
Cone	$V = \frac{1}{3}\pi r^2 h$	Exponential Growth/Decay	$A = A_0 e^{k(t-t_0)} + B_0$
Pyramid	$V = \frac{1}{3}Bh$		

Test 1

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the space provided the numeral preceding the word or expression that best completes the statement or answers the question. [48]

1. Simplify $8i^6 + 6i^5 - 5i^3 - 3i^2 - 7i - 9$

- (1) $-14 + 4i$ (2) $-4 + 4i$ (3) $-10i$ (4) $-14 - 18i$ 1 _____

2. In a family with 3 children, what is the probability that they have 2 boys and 1 girl?

- (1) $\frac{3}{8}$ (2) $\frac{1}{4}$ (3) $\frac{1}{8}$ (4) $\frac{1}{2}$ 2 _____

3. Given that $(\sqrt[4]{x})^4 = x$, which of the following expressions is equivalent to $\sqrt[4]{x}$?

- (1) $x^{\frac{1}{4}}$ (2) $x^{\frac{1}{8}}$ (3) x^4 (4) $\frac{x}{4}$ 3 _____

4. Richard's wallet contains four \$1 bills, three \$5 bills, and one \$10 bill. If Richard randomly removes two bills without replacement, which of the following is true?

- (1) The probability the bills will total \$15 is greater than the probability that the bills will total \$2.
(2) The probability the bills will total \$15 is less than the probability that the bills will total \$2.
(3) The probability the bills will total \$15 is equal to the probability that the bills will total \$2.
(4) The probability cannot be determined.

4 _____

5. Does the function $y = 4^{-2x}$ represent exponential growth or decay? What is the percent rate of change?

- (1) exponential growth; 4% (3) exponential growth; 83.5%
(2) exponential decay; 93.75% (4) exponential decay; 6.25% 5 _____

6. Determine the points of intersection for $x^2 + y^2 = 1$ and $y = x + 1$.

- (1) $(0, -1)$ and $(1, 0)$ (3) $(1, 0)$ and $(0, 1)$
(2) $(-1, 0)$ and $(0, 1)$ (4) $(-1, 0)$ and $(1, 1)$ 6 _____

7. Which equation has the same solutions as $(x - 5)^2 = -9$?

- (1) $x^2 - 10x = -34$ (3) $-2(x - 5)^2 = -18$
(2) $2x^2 - 20x = -34$ (4) $(x - 5)^2 + 6 = 3$ 7 _____

Test 1

8. Which of the following could identify the transformation of a parabola with a vertex of $(-4, -6)$ to parabola with a vertex of $(1, -6)$?

- (1) $f(x) + 5$ (2) $5f(x)$ (3) $f(x + 5)$ (4) $f(x - 5)$ 8 _____

9. The speed of a car is typically measured in miles per hour. If Sarah is collecting data about how far a car travels while it is stopping, what would be a better unit of measure for the speed of the car?

- (1) feet per second (2) feet per hour
(3) feet per minute (4) kilometers per hour 9 _____

10. Which of the following is *not* equivalent to $\cos \frac{\pi}{5}$?

- (1) $\cos \frac{-\pi}{5}$ (2) $\cos \frac{9\pi}{5}$ (3) $\cos \frac{4\pi}{5}$ (4) $\cos \frac{11\pi}{5}$ 10 _____

11. The expression $x^2(x + 3) - 9(x + 3)$ is equivalent to $(x + 3)^n(x - 3)$ when n equals

- (1) 0 (2) 2 (3) 1 (4) 3 11 _____

12. A car depreciates at a rate of 15% per year. If a new car is bought at a price of \$35,000, which of the following is a recursive formula that models the price of the car n years after the car was purchased?

- (1) $a_n = 35,000(.15)^n$ (3) $a_n = 35,000(.85)^n$
(2) $a_0 = 35,000, a_n = .15(a_{n-1})$ (4) $a_0 = 35,000, a_n = .85(a_{n-1})$ 12 _____

13. Jerome uses the polynomial identity $(x^2 - y^2)^2 + (2xy)^2 = (x^2 + y^2)^2$ to generate the Pythagorean Triple, 9, 40, 41. What values x and y did he use to generate the values for the three sides of a right triangle?

- (1) $x = 3, y = 4$ (3) $x = 4, y = 5$
(2) $x = 9, y = 40$ (4) $x = 16, y = 25$ 13 _____

14. An Algebra 2 class conducts a survey of a random sample of 50 students to determine what percent of the student body lives in a household where the annual income is over \$60,000.

According to their survey, 42% of the students live in such a household.

The students conduct a series of simulations to determine a margin of error for this sample proportion. The results of the simulations lead the students to conclude that the actual percent of students who live in families with an income over \$60,000 is $42\% \pm 8\%$. Based on this margin of error, it is most *unlikely* that this percent of students live in households earn over \$60,000 per year.

- (1) 33% (2) 48% (3) 42% (4) 50% 14 _____

Test 1

15. The concentration of a drug in milligrams in a medical patient's bloodstream is modeled by $f(x) = \frac{20}{t^2 + 1}$ where $t > 0$ is in hours and $f(x)$ is in milligrams per liter. The patient should not take a second dose until the concentration is no more than 2 milligrams per liter. What is the shortest time the patient should wait before taking a second dose?

- (1) 1.5 hours (2) 2 hours (3) 3 hours (4) 3.5 hours 15 ____

16. Movie Warehouse asked 1000 customers how they prefer to view movies. The results are summarized in the table below.

	DVD or BluRay	Netflix or similar provider	Online Downloads
Age Under 35	52	145	186
Age 35-55	108	110	56
Age over 55	250	75	18

To the nearest percent, what is the probability that a customer would prefer to view movies via online downloads given that they are under 35 years old?

- (1) 19% (2) 72% (3) 49% (4) 94% 16 ____

17. Sarah graphs the function $g(x) = 5x^2 + 30$ and observes that $g(x)$ has no x -intercepts. She uses this information to conclude that there are no solutions to the equation $5x^2 + 30 = 0$. To verify her conclusion, Sarah solves the equation $5x^2 + 30 = 0$ algebraically, and gets two solutions. Which statement is true about this situation?

- (1) Sarah's original conclusion was correct. There are no solutions to the equation $5x^2 + 30 = 0$. She made a mistake when solving the equation algebraically.
 (2) Sara's original conclusion was false. The equation has two complex solutions, $-6i$ and $6i$.
 (3) Sara's original conclusion was false because she graphed $g(x)$ incorrectly. The x -intercepts of $g(x)$ are $-\sqrt{6}$ and $\sqrt{6}$ and these values are also the solutions to the equation $5x^2 + 30 = 0$.
 (4) Sara's original conclusion was false. The equation has two complex solutions, $i\sqrt{6}$ and $-i\sqrt{6}$.

17 ____

18. A mathematics teacher has a box of 11 calculators—three that are defective and eight that are good. If two calculators are selected with replacement, what is the probability that they are both defective?

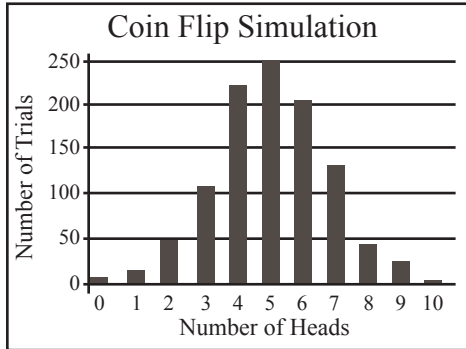
- (1) $\frac{9}{121}$ (2) $\frac{64}{121}$ (3) $\frac{3}{55}$ (4) $\frac{6}{11}$ 18 ____

19. Which of the following functions decreases as the input values approach both negative infinity and positive infinity?

- (1) $f(x) = x^3 - 4x^2 + x$ (3) $g(x) = -2x^3 - 4x^2 + 9$
 (2) $h(x) = x^4 - 4x^3 + 2x + 8$ (4) $r(x) = -x^4 + 9x^3 + x^2 + 8x + 2$ 19 ____

Test 1

20. Connor flipped a coin 10 times. Seven of the ten flips were heads. He wants to determine if the coin is fair, so he uses computer software to simulate how many times a coin will result in heads on 10 coin flips. Connor completes 1000 trials of the ten coin flips. The results are summarized in the table below.



Based on the simulation results, should Connor conclude that the coin is fair?

- (1) No, because 7 was not the most frequent outcome.
- (2) Yes, because 7 was not the least frequent outcome.
- (3) No, because a 7 did not occur more than 50% of the time.
- (4) Yes, because 7 was not an unusual outcome.

20 _____

21. The accompanying table shows the amount of money owed on a college loan t years after graduation.

t , in years since graduation	1	3	4	6	9
b , in thousands of dollars	8.579	6.328	5.641	3.791	1.812

Find the linear regression equation and determine the x -intercept.

- (1) $x = 11$; 11 represents the initial amount of money owed in college loans.
- (2) $x = 11$; 11 represents the number of years it will take to pay off the loans.
- (3) $x = 12$; 12 represents the initial amount of money owed in college loans.
- (4) $x = 9$; 9 represents the number of years it will take to pay off the loans

21 _____

22. In order to successfully perform a trick, a flying trapeze artist must swing along a parabolic path that is equidistant from the floor and the pivot point where the trapeze rope is attached. The rope is attached to the ceiling 8 feet out and 16 feet above her starting point and the floor is 8 feet below her starting point. Use the focus of $(8, 16)$ and directrix at $y = -8$ to determine the equation of the parabola.

- (1) $y = \frac{1}{16}(x - 8)^2 + 4$
- (2) $x = \frac{1}{32}(y - 16)^2$
- (3) $x = (y - 8)^2 + 4$
- (4) $y = \frac{1}{48}(x - 8)^2 + 4$

22 _____

Test 1

23. Find the percent change to the nearest percent for the following

function: $f(x) = 2(1 - .3)^{-x}$

- (1) 30% (2) 43% (3) 70% (4) 60% 23 _____

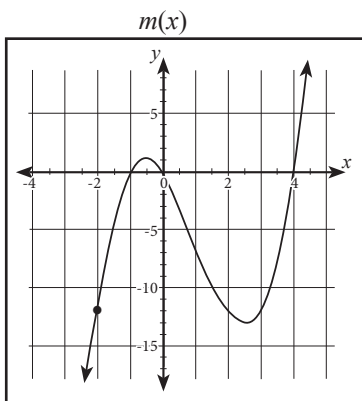
24. Which of the three functions has the largest and smallest average rate of change from $x = -2$ to $x = 4$?

$g(x)$

x	$g(x)$
-4	-8
-2	0
0	8
2	0
4	-8
6	0
8	8

$h(x)$

$$h(x) = |2x + 3| + 7$$



- (1) Largest: $h(x)$ Smallest: $m(x)$ (3) Largest: $m(x)$ Smallest: $g(x)$
 (2) Largest: $h(x)$ Smallest: $g(x)$ (4) Largest: $m(x)$ Smallest: $h(x)$ 24 _____

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25. Monthly mortgage payments can be calculated according to the formula,

$$A = \frac{Mp^n(1-p)}{(1-p^n)}$$

where M is the size of the mortgage, n is the number of compounds per year, t is the length of the mortgage, in years, and $p = \left(1 + \frac{r}{n}\right)$

where r is the interest rate as a decimal. What would the monthly mortgage payments be on a \$180,000, 15 year mortgage with 6% interest, compounded monthly, to the nearest dollar?

Test 1

26. A boy standing on the top of a building in Albany throws a water balloon up vertically. The height, h (in feet), of the water balloon is given by the equation $h(t) = -16t^2 + 64t + 192$, where t is the time (in seconds) after he threw the water balloon. What is the value of t when the balloon hits the ground? Explain and show how you arrived at your answer.

27. Manuel calculates the exponential regression for the following data to be $y = 5.528(1.830)^x$. Fill in the third column of the table with the predicted y -values based upon the regression equation, to the *nearest whole number*.

x	y (actual)	y (predicted)
0	5	
1	10	
2	21	
3	38	
4	85	
5	50	
6	302	

Manuel compares the actual and predicted y -values, and determines that the exponential regression is not a good fit for the data. Explain why there are large differences between the actual and predicted y -values.

28. Home heating oil currently costs \$3.75 per gallon, and Chase wants to put gas in his 500-gallon tank. If n represents the number of gallons of oil he purchases, and $c(n)$ represents the cost of the oil purchase. Determine the best domain and range for the function.

Test 1

29. A randomized, controlled experiment is conducted in which the researcher is deciding if exercise has an impact on the number of days people are sick each year. The control group in the experiment is sick an average of 10 days per year with a standard deviation of 1.6 days. The experimental group is sick an average of 7.2 days a year with a standard deviation of 0.7 days.

If the standard deviation of the experimental group was 1.2 days instead of 0.7 days, would this increase or decrease the chance that there was a significant difference between the two groups? Explain your answer.

30. Katherine wants to construct a small box with a volume of 20 cubic inches with the following specifications. The length of a box is five more than its width. Its depth is one less than its width. What are the dimensions of the box in simplest radical form and rounded to *the nearest hundredth*? Only an algebraic solution will receive full credit.

31. The amount of money left on a loan that Kira owes her grandmothers is represented by the function $k(t) = 280(.88)^t$ where $k(t)$ represents the amount of money left on the loan and t represents the time, in years.

Identify $k(t)$ as a growth or decay and explain your answer.

Name A_0 , the starting amount and explain what it represents.

Find r , the percent change and explain what it represents.

Test 1

32. Solve the following equation and explain each step used in solving the equation.

$$\frac{3}{x-3} = \frac{1}{x-1} + \frac{7}{(x-1)(x-3)}$$

Part III

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [7]

33. The chart below shows the average daily high temperature each month for Saugerties, NY.

Month	Average Daily High Temperature
1 (January)	34
2 (February)	38
3	48
4	62
5	73
6	81
7	85
8	82
9	74
10	63
11	51
12	39

Write a sine regression equation to model the average daily temperature as a function of the month of the year for Saugerties, New York. Round coefficients to *the nearest hundredth*.

Using your regression, what is the predicted average daily high in September?

How far is this value from the actual value in the table?

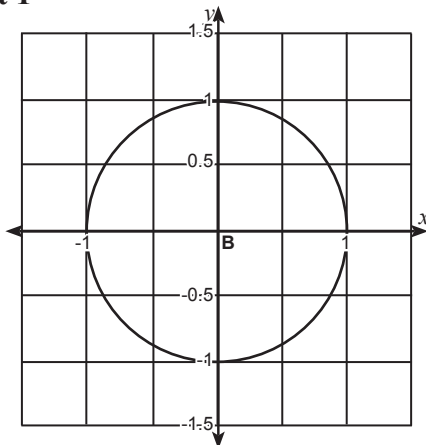
Test 1

34. The unit circle is pictured.

On the diagram, sketch an angle in standard position that subtends an arc of $\frac{5\pi}{3}$ radians.

What is the point of intersection between the angle and the unit circle?

Name one other angle, in radians, that passes through the same point.



35. Mrs. Reynolds wanted to see how the amount of homework her students completed was related to their test averages for the year. She organized the following data for her 110 students using an online grade book program.

Use the following two way frequency table to answer the questions below:

Homework Completion and Test Average				
	Average Below 70%	Average 70 – 85%	Average 85 – 100%	Total
85-100% HW complete	2	15	22	39
70-85% HW complete	4	36	8	48
Less than 70% HW complete	10	12	1	23
Total	16	63	31	110

Determine each of the following probabilities for a student chosen randomly from her group of students:

Average 70% – 85%:

Average 85% – 100% and less than 70% of homework complete:

85% – 100% of homework complete or average 85% – 100%:

Average 70 or higher given that the student does 85% – 100% of the homework:

36. Use long division to divide $(x^3 + 7x^2 + 14x + 3)$ by $(x + 2)$.

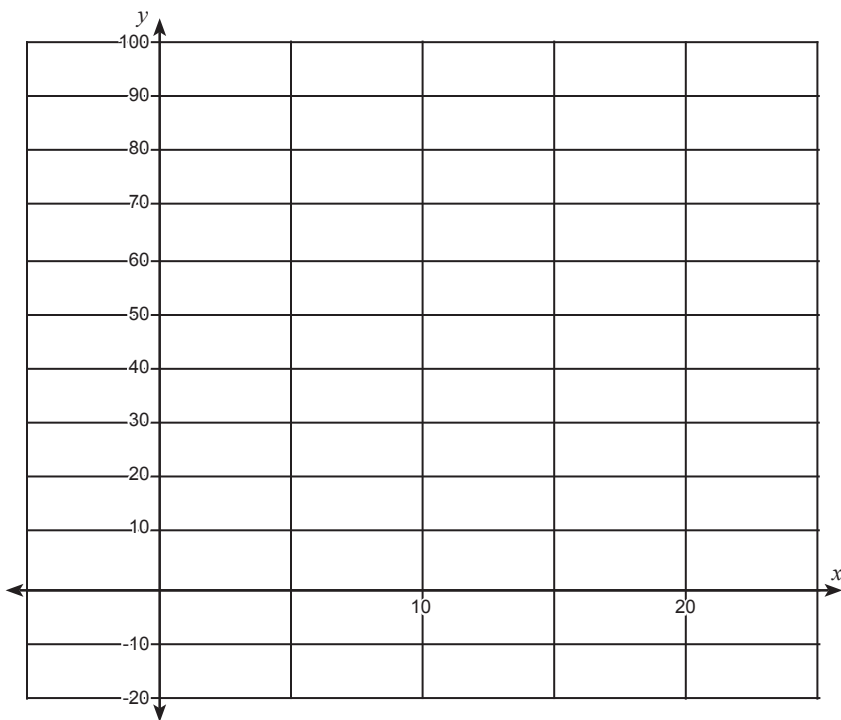
Is $x + 2$ a factor of $x^3 + 7x^2 + 14x + 3$? Explain why or why not.

Test 1
Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37. The temperature, in Fahrenheit, in a small town in New York x months after January 1st can be modeled by the function, $y = -40\cos \frac{\pi}{6}x + 50$

Graph the function over the interval $0 \leq x \leq 24$ on the grid below. Identify the period, midline, and amplitude of the function, and label these values on the graph. Explain what each means in the context of the function.



Test 2

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the space provided the numeral preceding the word or expression that best completes the statement or answers the question. [48]

1. The factors of $x^4 - 13x^2 + 36$ when factored completely are

- (1) $(x^2 + 9)(x^2 + 4)$ (3) $(x + 3)(x - 3)(x + 2)(x - 2)$
 (2) $(x^2 + 9)(x + 2)(x - 2)$ (4) $(x + 3)(x + 3)(x + 2)(x + 2)$ 1 _____

2. What is the length of the arc on the unit circle subtended by an angle of 120° ?

- (1) $\frac{2}{3}$ (2) $\frac{1}{3}\pi$ (3) $\frac{2}{3}\pi$ (4) π 2 _____

3. A baseball is hit straight up from a height of 6 feet with an initial velocity of 90 feet per second. Given the equation, $(s = -16t^2 + v_0t + s_0)$ that models the height of the ball, s , as a function of time, t . The initial height of the ball is s_0 and the initial velocity is v_0 . How high is the ball after 4 seconds?

- (1) 110 (2) 622 (3) 6 (4) 5 3 _____

4. Kayla needs \$30,000 for a down payment on a house she plans to purchase in 8 years. She decides to invest in a savings account which gets 3.5% interest, compounded at the end of each year. Assume she makes the same deposit on January 1st each of the 8 years and makes no other deposits or withdrawals throughout the year. Use the formula, $A = \frac{d}{r}((1 + r)^t - 1)$ where A is the amount of money in the account after t years, d is the number of dollars invested at the beginning of each year, and r is the annual interest rate of the account, expressed as a decimal. How much money should Kayla put in the account at the beginning of each year to reach her goal?

- (1) 3,152 (2) 3,623.19 (3) 3,314.30 (4) 3,750 4 _____

5. The best sampling method for obtaining a random sample of students who represent the entire population of a high school would be

- (1) Selecting every other person entering the weight room
 (2) Selecting every fifth person entering the school building
 (3) Selecting the first thirty people entering the cafeteria
 (4) Asking for volunteers in physical education class 5 _____

6. A game wheel has 38 slots numbered 1-38, respectively. Matt places a bet on the odd numbers and Julie places a bet on numbers 10, 11, 13, and 14. What is the probability of landing on an odd number or 10, 11, 13, or 14?

- (1) $\frac{2}{3}$ (2) $\frac{19}{38}$ (3) $\frac{9}{19}$ (4) $\frac{21}{38}$ 6 _____

Test 2

7. What are the roots of the equation $x^2 - 4x + 13 = 0$?

(1) $\{2 - 3i, 2 + 3i\}$

(3) $\{-2 - 3i, 2 + 3i\}$

(2) $\{2 - \sqrt{17}, 2 + \sqrt{17}\}$

(4) $\{-2 - \sqrt{17}, -2 + \sqrt{17}\}$

7 _____

8. Which of the following expressions is equal to a ?

(1) $(a^b)^{\frac{1}{b}}$

(2) $(a^b)^b$

(3) $\frac{a^b}{a^b}$

(4) $(a^b)^{-\frac{1}{b}}$

8 _____

9. Which of the following methods should a researcher use to study the effects on a baby whose mother used drugs during her pregnancy?

(1) experiment

(3) sample survey

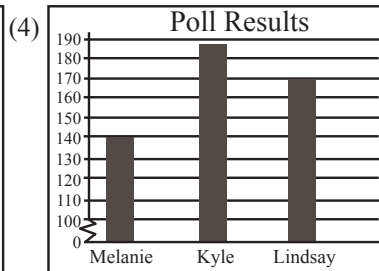
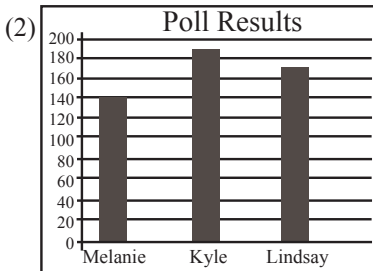
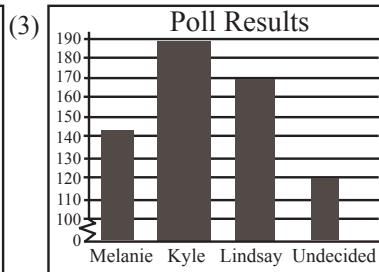
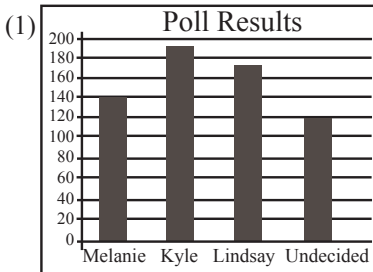
(2) census

(4) observational study

9 _____

10. Jefferson High School conducted a poll of its students to determine who was in the running for student body vice president. The results are summarized in the table below. Which of the following graphs most accurately depicts the results if 621 students were surveyed?

Name	Votes
Melanie	142
Kyle	189
Lindsay	170



10 _____

11. $p(a)$ is the remainder when $x^3 + 3x^2 - 18x - 40$ is divided by $x - a$. For which value of a would $p(a) = 0$?

(1) 2

(2) 3

(3) -2

(4) -3

11 _____

Test 2

18. The world's highest ferris wheel, the High Roller, reaches a maximum height of 550 feet and a minimum height of 30 feet above the ground. It takes 30 minutes to complete one revolution on the High Roller. Which trigonometric function best models the height, in feet, above the ground of a passenger on the High Roller where t is the number of minutes since the passenger entered the car at the minimum point?

(1) $h(t) = -550 \cos\left(\frac{\pi}{15}t\right)$

(3) $h(t) = -260 \cos\left(\frac{\pi}{15}t\right) + 290$

(2) $h(t) = -550 \cos(30t)$

(4) $h(t) = -260 \cos(30t) + 290$

18 ____

19. Jason is collecting data about his town. He is interested in where people live and their annual household income level. He collects the following data:

	Lives in District A	Lives in District B	Total
Income below \$50,000	10,957	647	11,604
Income \$50,000-\$80,000	3,045	8,754	11,799
Income \$80,000 and above	527	2,340	2,867
Total	14,529	11,741	26,270

Jason calculates the probability that a family lives in District A given that they have a household income level below \$50,000. He also wants to use the information in the table to determine if these two events, living in District A and income below \$50,000, are independent or dependent events. Which of the following gives the correct answer to both of his problems?

(1) 94%, The two events are independent

(2) 75%, The two events are independent

(3) 94%, The two events are dependent

(4) 75%, The two events are dependent

19 ____

20. Ricky is designing a new website. On the first day of setting up his new website, there are 16 features on the page. On the second day, there are 20. On the third day, there are 24. On the fourth day, there are 28.

To obtain his goal launch date, he wants to continue in this pattern.

How many features will there be in all after 15 days?

(1) 64

(2) 72

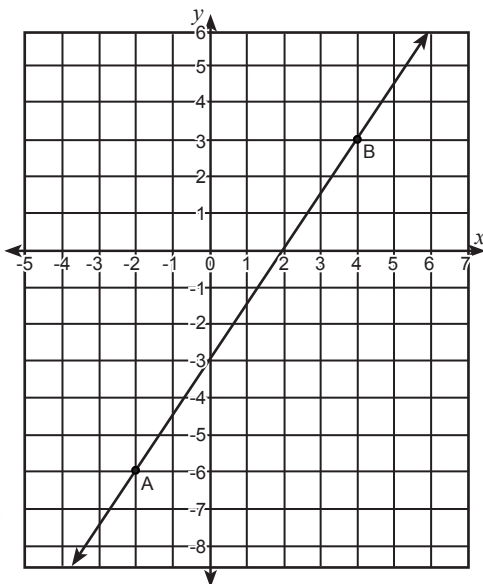
(3) 76

(4) 84

20 ____

Test 2

21. $k(x)$ passes through points A and B as graphed. It's equation is written in the form, $y = mx + b$. How would the equation of $k(x)$ change if point B were translated three units down?



- (1) m would decrease by 3 and b would decrease by 1.
- (2) m would decrease by 0.5 and b would decrease by 3
- (3) m would remain the same and b would decrease by 3
- (4) m would decrease by 0.5 and b would decrease by 1

21 _____

22. 48.6% of the North Dakota population over 18 years old is female. 65.9% of the total population of North Dakota over 18 years old has enrolled in college at some point in their lives. If these two events are independent of each other, what is the probability that a randomly selected adult in North Dakota will be a female who has enrolled in college, to the nearest percent.

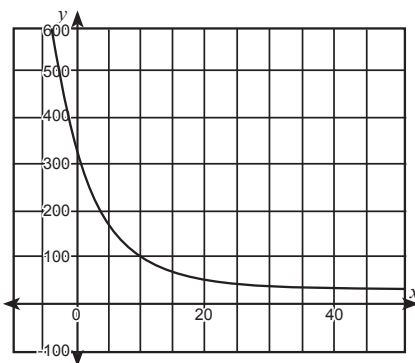
- (1) 32%
 - (2) 49%
 - (3) 33%
 - (4) 66%
- 22 _____

23. What is the 13th term of the sequence? $A = \{3, 6, 12, \dots\}$

- (1) 4,096
 - (2) 8,192
 - (3) 12,288
 - (4) 24,576
- 23 _____

24. The accompanying function models the cost, in dollars, of a designer necklace x years after it was purchased? If the trend continues and the necklace is sold 100 years after it was first purchased, use the graph to approximate the cost at the time it is sold.

- (1) 5
- (2) 38
- (3) 12
- (4) 72



24 _____

Test 2
Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25. Simplify the following expression. Justify each step using the commutative, associative and distributive properties. $(-3 + 8i)(-5 - 2i)$

26. What is the inverse of $h(x) = 12e^{2x}$? Based on your answer, write an expression equivalent to x where $h(x) = 10$.

27. The number of ticks in an infested field is decreasing with the use of a new pesticide. Below is a table which shows the number of ticks in the field after x applications of the pesticide.

x , number of applications	0	1	2	3	4
y , number of ticks	5000	4000	3200	2560	2048

Determine an exponential equation of the form $y = a \cdot b^x$ that models this data.

28. Prove that $2^{\frac{3}{4}} = \sqrt[4]{2^3}$.

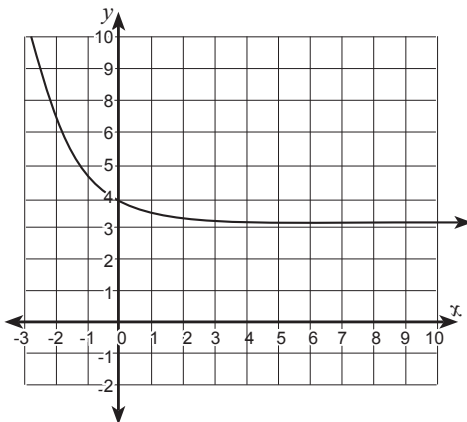
Test 2

29. Brentwood High School has a population of 1,527 students. 50 of the school's students were surveyed at a dance to determine the number of hours the average student at the high school works each week. List two ways the survey could be improved so that data from the sample has the best chance of accurately reflecting the Brentwood High School population.

30. $f(x) = \frac{x+2}{x^2+2x-3}$ Determine the x and y intercepts and the asymptotes of the graph.

31. Given the graph of the following function on the coordinate axes, describe the intercepts and end behavior of the graph.

$$f(x) = \left(\frac{1}{2}\right)^x + 3$$



32. Determine all values of k for which the roots of the equation $x^2 - 6x + k = 0$ are complex. Justify your solution.

Test 2
Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. It is known that 64% of the people in Kyle's town went to see a movie in the last month. Kyle uses simulation software to generate the results of 100 random samples of 50 people from his town using the known population proportion, 0.64. For simplification purposes, Kyle organizes the sample proportions, rounded to the nearest *even* hundredth to make the data easier to work with, in a frequency table.

What are the mean and standard deviation of the sample proportions, to the nearest *hundredth*?

Calculate a margin of error to include proportions two standard deviations above and below the mean.

Sample Proportion	Frequency
.42	1
.46	1
.52	2
.54	4
.58	6
.60	9
.62	14
.64	13
.66	12
.68	8
.70	11
.72	4
.74	6
.76	3
.78	4
.82	2

Kyle samples 50 people in his town and 73% of them saw a movie in the last month. Could this result happen by chance or did Kyle a group that does not represent the population of his town? Justify your answer.

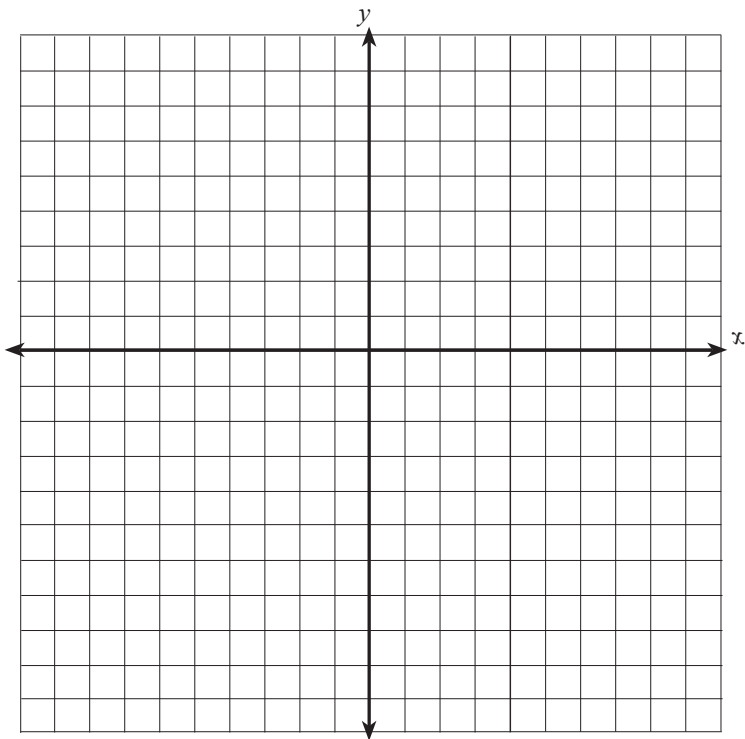
34. In function notation, write $A(x)$ to represent the total cost of attending carnival A and going on x rides. The initial cost for attendance to carnival A is \$12 and each ride costs \$2. In function notation, write $B(x)$ to represent the total cost of attending carnival B and going on x rides. The initial cost for attendance to carnival B is \$16 and each ride costs \$1.50.

Determine the number of rides Jerry can go on such that the total cost of attending each carnival is the same.

Jerry wants to go on five rides. Determine which carnival would have the lower total cost. Justify your answer.

Test 2

35. Graph $f(x) = x^3 - 2x - 4$. Based on the graph, what is the real solution to the equation $x^3 - 2x - 4 = 0$? Verify algebraically that it is a zero of $f(x)$.



Write $f(x)$ as a product of a linear factor and a quadratic factor.

Find the two complex number zeros of $f(x)$.

36. The point $P = \left(\frac{8}{17}, \frac{15}{17}\right)$ is a point on the circle $x^2 + y^2 = 1$. What Pythagorean triple is associated with the point P on this circle? Use the equation of the circle to prove that this is a point on the circle.

Test 2
Part IV

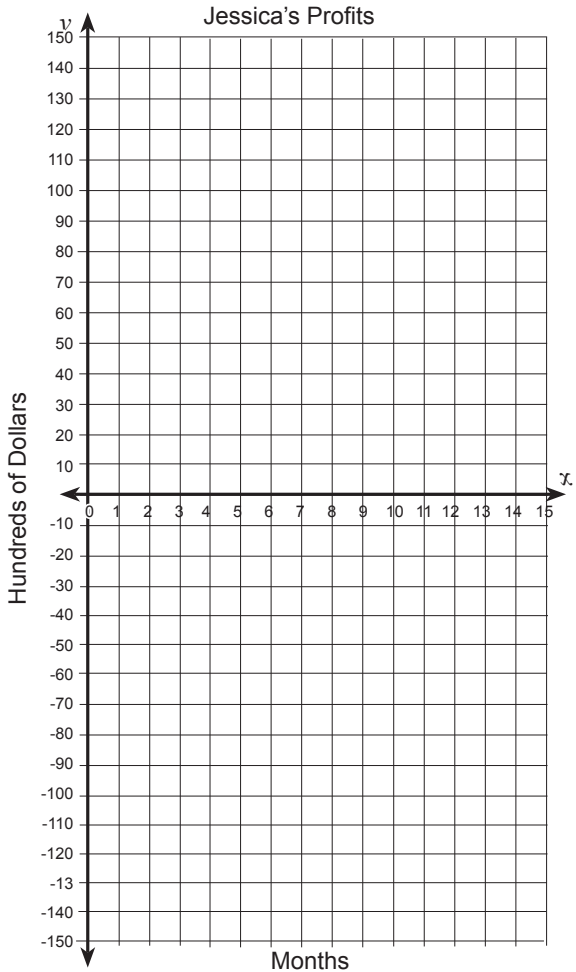
Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6

37. Jessica started a new bracelet company. Her net monthly profit in hundreds of dollars can be modeled by the function $h(x) = x^3 - 18x^2 + 92x - 120$ where x is the month of the year ($x = 1$ is January). Graph Jessica's profit function on the axes provided using the domain $\{1, 2, 3, \dots, 10, 11, 12\}$.

In what month did Jessica make the most money?

During what month(s) did her profit decrease from the previous month?

Do you think $g(x)$ will model Jessica's profits over the next year, when x is an integer such that $13 \leq x < 24$? Explain your answer.



Test 3

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the space provided the numeral preceding the word or expression that best completes the statement or answers the question. [48]

1. The Pell numbers can be defined recursively by the formula, $p(1)=0$, $p(2)=1$. What is the value of $p(6)$? $p(n) = 2p(n-1) + p(n-2)$

- (1) 1 (2) 20 (3) 5 (4) 29 1 _____

2. The table below shows the results of a survey in which workers between the ages of 26 and 45 were asked if they have at least one month's income set aside for emergencies.

	Men	Women
Less than one month's income	66	83
One month's income or more	76	62

If two *different* workers are randomly selected, find the probability that they both have one month's income or more set aside for emergencies.

- (1) 64% (2) 24% (3) 48% (4) 23% 2 _____

3. A controlled experiment would be most appropriate for which of the following studies?

- (1) Determining student's lunch preferences.
 (2) Determining if calculator use improves test grades.
 (3) Determining the personality factors that help children develop friendships.
 (4) Determining which sports team is the favorite of the female students in a school.
- 3 _____

4. Which expression is equivalent to $(8x^4y^6)^{\frac{1}{3}}$?

- (1) $2xy^2$ (2) $2xy^2\sqrt[3]{x}$ (3) $\frac{8}{3}xy^2\sqrt[3]{x}$ (4) $\sqrt[3]{2x^4y^6}$ 4 _____

5. Solve for x : $\sqrt{x-1} = x-7$

- (1) {10, 5} (2) $\{5\sqrt{2}\}$ (3) $\{-7, 7\}$ (4) {10} 5 _____

6. Sabrina is playing ball with her dog. She throws the ball in a parabolic path that can be modeled by the function $y = -\frac{1}{2}(x-3)^2 + 7$. Her brother, Bobby, is playing in a tree next to her. Bobby shines his laser pointer from the tree in a line that can be modeled by the function $y = -\frac{1}{2}x + 8.5$. At what point(s) will the the ball and the laser beam intersect?

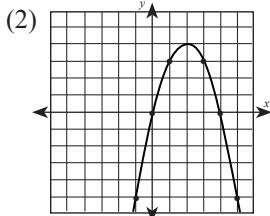
- (1) (3, 7) (3) (3, 7) and (4, 6.5)
 (2) (4, 6.5) (4) (7, 8.5) and (0.5, 3)
- 6 _____

Test 3

7. Determine which of the following has the largest maximum:

(1) $x^2 + y = 4x - 8$

(3) $y = -(x - 3)^2 + 5$



(4)

x	y
3	-1
4	2
5	3
6	2
7	-1

7 _____

8. Professor Malg has 184 students in her mathematics class. The scores on the final examination are normally distributed and have a mean of 72 and a standard deviation of 9. What percentage of the students in the class can be expected to receive a score between 81 and 90?

(1) 13.6%

(2) 47.7%

(3) 68.2%

(4) 95.4%

8 _____

9. If $\sin \theta = \frac{7}{25}$ where θ is an angle in standard position that terminates in quadrant II, what is the value of $\tan \theta$?

(1) $\frac{7}{24}$

(2) $-\frac{7}{24}$

(3) $\frac{24}{7}$

(4) $-\frac{24}{7}$

9 _____

10. How many complex roots does the following polynomial function have?

$$P(x) = (x^2 - 5)(x^2 + 4)(x^2 + 10)(2x + 6)$$

(1) 0

(2) 2

(3) 3

(4) 4

10 _____

11. Find the values of x , y , and z in the following system of equations:

$x + 2y - z = 3$
$2x + y + z = 0$
$x + 2y + z = 5$

(1) $x = 1, y = 0, z = 0$

(3) $x = -2, y = 3, z = 1$

(2) $x = 5, y = -4, z = -1$

(4) $x = -2, y = 4, z = -3$

11 _____

12. The function $P(t) = 43,000e^{-0.025t}$ models the population of a city, in hundreds, t years after 2010. How many people lived in the city in 2010 at what rate is the population changing?

(1) 43,000 Increasing by 2.5% each year

(2) 4,300,000 Increasing by 2.5% each year

(3) 43,000 Decreasing by 2.5% each year

(4) 4,300,000 Decreasing by 2.5% each year

12 _____

13. If events A and B are independent events, which of the following is not necessarily true.

(1) $P(A) \cdot P(B) = P(A \text{ and } B)$

(3) $P(A | B) = P(A)$

(2) $\frac{P(B | A)}{P(B)} = 1$

(4) $P(B | A) = P(A)$

13 _____

14. Solve $x^2 - 12 = -7x$.

(1) -3 and -4

(3) 3 and 4

(2) $\frac{-7 - \sqrt{97}}{2}$ and $\frac{-7 + \sqrt{97}}{2}$

(4) $\frac{7 - \sqrt{97}}{2}$ and $\frac{7 + \sqrt{97}}{2}$

14 _____

Test 3

15. A rabbit farm currently has 25 rabbits. This population doubles every three months which can be represented by the equation, $r(t) = 25(2)^{4t}$ where t is years since the population was 25 rabbits. If the farm does not sell any of their rabbits, after how many months, to the *nearest whole number*, will there be 3,000 rabbits on the farm?

- (1) 2 (2) 21 (3) 6 (4) 25 15 ____

16. Kyle finds data on the Internet about carbon dating. The following table shows the years since an organism's death and the concentration of C^{14} atoms in the organism. Which type of regression would best model this situation?

Years since death	C^{14} atoms remaining per 1.0×10^8 C^{12} atoms
0	10,000
5,700	5,000
11,400	2,500
17,100	1,250
22,800	625
28,500	312
34,200	156
39,900	78

- (1) linear (2) logarithmic (3) exponential (4) trigonometric 16 ____

17. Suppose you select a person at random from a large group at a conference. What is the probability that the person selected has a birthday that is not in August?

- (1) $\frac{31}{365}$ (2) $\frac{6}{73}$ (3) $\frac{334}{365}$ (4) $\frac{11}{12}$ 17 ____

18. Divide $x^2 - 3x - 28$ by $x - 7$.

- (1) $x - 4$ (2) $x + 4$ (3) $x - 7$ (4) $x + 7$ 18 ____

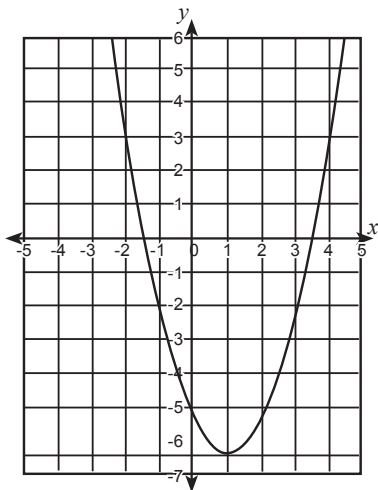
19. Two methods of instruction were used to teach young athletes how to shoot a basketball. The methods were assessed by assigning students to two groups, one that was taught with method A and one that was taught with method B . The students in each group took 30 foul shots after each of ten sessions. The average number of shots made in each of the x rounds by an athlete using method A can be modeled by the function, $A(x) = 11.90 + 4.3 \ln x$. The average number of foul shots made in each of the x rounds for an athlete using method B can be modeled by the function, $B(x) = 9.17(1.109)^x$. In which of the 10 rounds will the number of baskets made with each method be closest?

- (1) 6 (2) 8 (3) 7 (4) 9 19 ____

Test 3

20. The graph of a quadratic function, $f(x)$, is shown to the right. What is the remainder when $f(x)$ is divided by $x - 2$?

- (1) -5
 (2) 3
 (3) -3
 (4) 5



20 _____

21. Write $(2 + i)^3$ in standard $a + bi$ form.

- (1) $2 + 11i$ (2) $2 + 13i$ (3) $8 + 17i$ (4) $8 + 19i$

21 _____

22. Which recursive definition models the growth of a one-time investment of \$6000 in a bank account with a yearly interest rate of 3%, compounded monthly, after n years.

(1) $a_0 = 6000, a_n = a_{n-1} \left(1 + \frac{.03}{12}\right)^{12}$ (3) $a_0 = 6000, a_n = a_{n-1} (1.03)$

(2) $a_0 = 6000, a_n = a_{n-1} (e)^{.03}$ (4) $a_0 = 6000, a_n = a_{n-1} \left(1 + \frac{3}{12}\right)^{12}$

22 _____

23. Find $g(x)$, the inverse of $f(x) = -2x + 5$.

(1) $g(x) = -\frac{x}{2} + \frac{5}{2}$ (3) $g(x) = 2x - 5$

(2) $g(x) = -\frac{x}{2} - \frac{5}{2}$ (4) $g(x) = \frac{1}{-2x + 5}$

23 _____

24. The table below lists the number of Americans (in thousands) who are expected to be over 100 years old for selected years.

Let x represent the number of years after 2010. Determine the quadratic regression equation for the data. Use the quadratic regression equation to predict the number of Americans who will be over 100 years old in the year 2026 to the nearest thousand.

- (1) 353,000 (3) 130,000
 (2) 288,000 (4) 132,000

Americans Over 100 Years of Age

Year	Number (in thousands)
2014	50
2016	56
2018	65
2020	75
2022	94
2024	110

24 _____

Test 3
Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25. Three hours after leaving her best friend's house, Jessica was 400 miles from home. Five hours after she left her house, she was 280 miles from home. Write a function where x represents the numbers of hours spent driving and $d(x)$ represents the distance from home.

26. $a(x) = -8x^4 - 10x^3 + 17x^2 - 4$ and $b(x) = 4x^2 - 5x + 2$.

Express $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$ where $r(x) < b(x)$.

27. Determine all of the factors of the expression $3x^3 + 7x^2 - 18x + 8$ if one of the factors is $x - 1$.

28. Solve the following equation: $4x^2 + 8x + 7 = 0$

Express your answer in simplest $a + bi$ form.

29. The height of the saddle of a horse above the base of a carousel can be modeled by the equation $f(x) = 12 \sin \frac{3\pi}{8}t + 42$, where t represents seconds after the ride started.

How much time does it take for the horse to complete one cycle of motion and return to its starting height.

What is the maximum height and the minimum height of the horse's saddle above the base of the carousel?

Test 3

30. Simplify: $i(4 - 2i) - (3 + 2i)(4 - 6i)$

31. Forest Gump went running for several hours. The table represents the number of miles he had run, m , after t hours. Is the average rate of change constant for this function? Justify your answer.

t , hours	2	4	7
m , miles	10	18	30

32. A survey was taken of student's genders and their preference for basketball, soccer, or track. 5 girls preferred track, 4 boys preferred track, 6 boys preferred basketball, and 15 girls preferred soccer. 25 students preferred soccer and a total of 50 students participated in the survey.

Complete the two-way frequency table comparing the gender of the students and their preferences for basketball, soccer, or track.

	Basketball	Soccer	Track	Totals
Male	6			20
Female		15		
Totals	16			

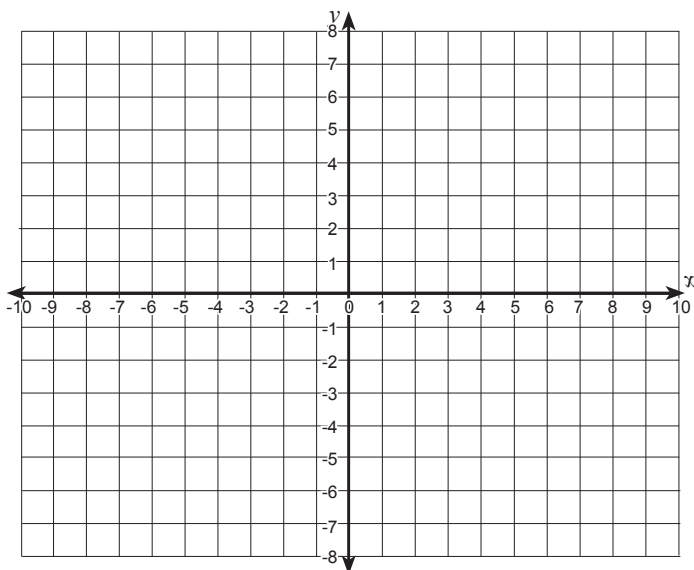
What is the probability that a student preferred basketball given that the student was a girl?

Are being female and preferring soccer independent events? Justify your answer.

Test 3
Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. Find the solution(s) to $f(x) = g(x)$ algebraically. $f(x) = |x - 4| + 2$
 $g(x) = \frac{1}{3}x + 2$



Determine the x -coordinate(s) of the point(s) of intersection of $f(x)$ and $g(x)$ graphically.

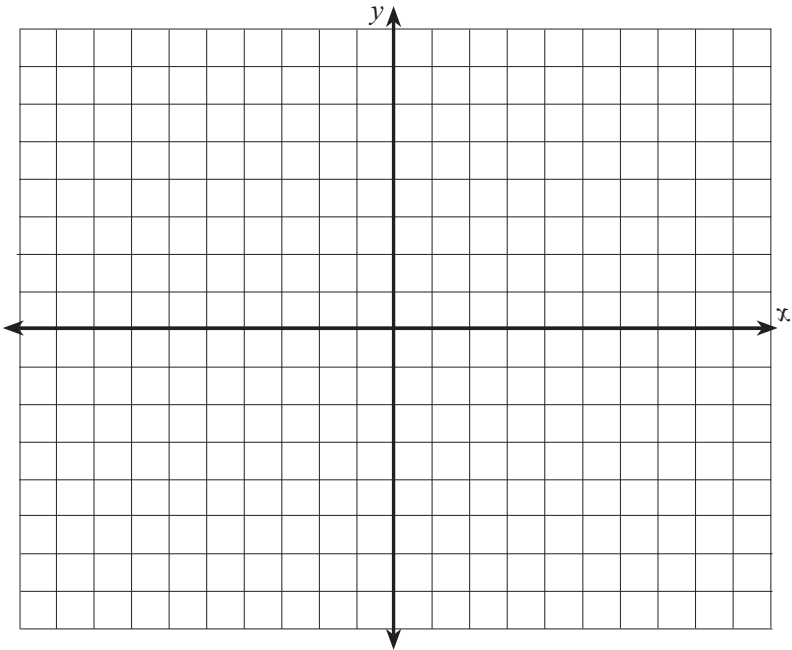
Explain the relationship between the answer to part a and part b .

Test 3

34. Factor completely: $x^4 - 25x^2 + 144$

Graph the function, $g(x) = x^4 - 25x^2 + 144$ labeling all x -intercepts.
Choose an appropriate scale for the independent and dependent variables.

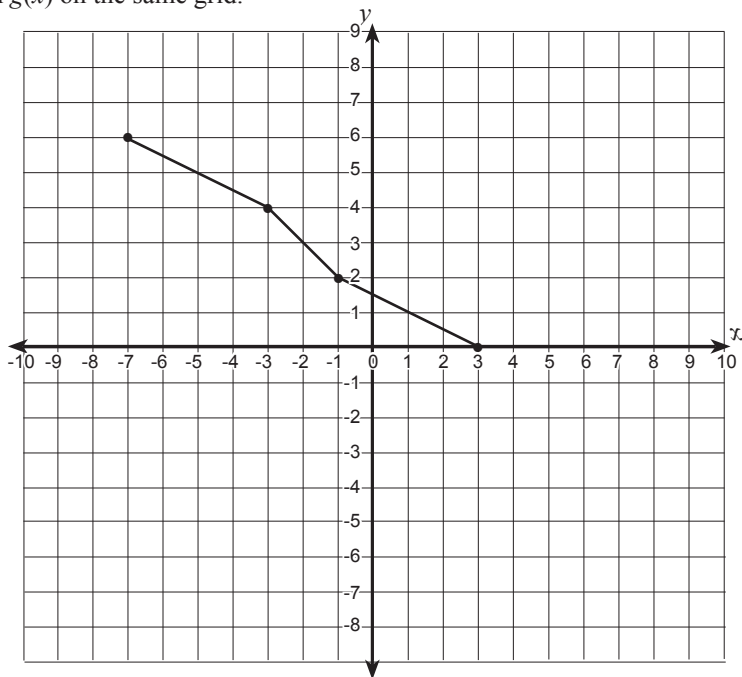
What is the connection between your answers?



Test 3

35. $f(x)$ is graphed on the grid below. $g(x) = f(x - 2) - 3$

Graph $g(x)$ on the same grid.



Is $g(x)$ even, odd, or neither? Justify your answer.

36. $f(x) = (x + 2)(x - 1)(x - 5)$

What is the y -intercept of $f(x)$?

What are the zeros of $f(x)$?

Is $f(x)$ increasing or decreasing over the interval $-3 < x < -1$?

How many relative extrema does $f(x)$ have?

Test 3
Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37. The table shows the relationship between total fat in grams and total calories in sandwiches from Marilyn's Sassy Sandwich Shop.

Total Fat (grams)	Total Calories
9	260
13	320
21	420
30	530
31	560
31	550
34	590
25	500
28	560
6	300
20	440

Find the linear regression equation for this information. Round the coefficients to the *thousandths* place.

What is the correlation coefficient to the *nearest thousandth*?

What does the correlation coefficient tell you about the data?

What is the slope? What does the slope tell you about the data?

Use your linear regression to predict the total calories for a sandwich with 10 grams of fat. Round your answer to the *nearest whole number*.

Test 4
Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the space provided the numeral preceding the word or expression that best completes the statement or answers the question. [48]

1. Functions f and g are defined such that $f(x) = \sin(x)$ and $g(x) = -\sin(2x) + 3$. Which sequence of transformations would map $f(x)$ to $g(x)$?

- | | | |
|---------------------------------|---------------------------------|---------|
| (1) Horizontal stretch of 2 | (3) Horizontal stretch of 2 | |
| Reflection in the x -axis | Reflection in the y -axis | |
| Translation up 3 | Translation left 3 | |
| (2) Horizontal compression of 2 | (4) Horizontal compression of 2 | |
| Reflection in the x -axis | Reflection in the x -axis | |
| Translation up 3 | Translation left 3 | 1 _____ |

2. The expression $\frac{16\left(x^{\frac{1}{4}}y^{-\frac{1}{2}}\right)^6}{\sqrt{9xy^4}}$ is equivalent to

- | | | | | |
|--------------------------|------------------------|----------------------|------------------------|---------|
| (1) $\frac{16x^3}{3y^5}$ | (2) $\frac{16x}{3y^5}$ | (3) $\frac{16xy}{3}$ | (4) $\frac{16}{3xy^5}$ | 2 _____ |
|--------------------------|------------------------|----------------------|------------------------|---------|

3. Solve for x : $x^2 - 4x + 4 = \frac{5}{2} + 4$

- | | | |
|--|---|---------|
| (1) $\left\{\frac{\sqrt{13}}{\sqrt{2}}, -\frac{\sqrt{13}}{\sqrt{2}}\right\}$ | (3) $\left\{2 + \frac{\sqrt{26}}{2}, 2 - \frac{\sqrt{26}}{2}\right\}$ | |
| (2) $\left\{\frac{17}{2}, -\frac{17}{2}\right\}$ | (4) $\left\{2 + \frac{\sqrt{13}}{2}, 2 - \frac{\sqrt{13}}{2}\right\}$ | 3 _____ |

4. The table below shows the results of a survey in which young adults ages 18-26 were asked if they ever used social media. Use the table to answer the question below.

	Female	Male
Used social media	153	126
Never used social media	39	32

Find the probability that randomly selected person is female or has never used social media.

- | | | | | |
|----------------------|----------------------|----------------------|---------------------|---------|
| (1) $\frac{39}{350}$ | (2) $\frac{71}{350}$ | (3) $\frac{96}{175}$ | (4) $\frac{16}{25}$ | 4 _____ |
|----------------------|----------------------|----------------------|---------------------|---------|

5. Which of the following products is equal to a real number?

- | | | |
|------------------------|------------------------|---------|
| (1) $(8 + 2i)(8 + 2i)$ | (3) $(8 + 2i)(8 - 2i)$ | |
| (2) $(2 + 8i)(8 + 2i)$ | (4) $(2 + 8i)(8 - 2i)$ | 5 _____ |

Test 4

6. Katherine plans to conduct a survey to collect data about the favorite pastimes of the citizens in her town. Her initial plan for distributing the survey is to call every tenth person in the phone book with the prefix for her town. Which of the following factors would be most likely to have a negative impact on the randomization of this method?

- (1) People with only cell phones (no land lines) would not be included.
 (2) It takes too long to call people on the phone.
 (3) The sample size will not be large enough.
 (4) There is nothing wrong with this method because a systematic method is used to call all the town residents.

6 _____

7. Which of the functions models the following relationship: the output is equal to the difference between the sum of the cube of the input and four times the square of the input, and the product of five and the input decreased by 7?

- (1) $f(x) = x^3 + 4x^2 - 5(x - 7)$ (3) $f(x) = x^3 + 4x^2 - 5(x + 7)$
 (2) $g(x) = x^3 + 4x^2 - 5x + 7$ (4) $j(x) = \sqrt[3]{x} + 4x^2 - 5x - 7$

7 _____

8. A baseball is hit straight up from a height of 6 feet with an initial velocity of 90 feet per second. The equation that models the height of the ball, s , as a function of time, t , is $s = -16t^2 + v_0t + s_0$. How high is the ball after 4 seconds?

- (1) 110 (2) 622 (3) 6 (4) 5

8 _____

9. Lacey is conducting a survey about the junior class's clothing preferences. Which of the following factors would have the *least* impact on the reliability of her sample?

- (1) the size of the sample
 (2) the day of the week (M-F) she conducts the survey
 (3) the gender of the students in the sample
 (4) the location where she chooses to find students to sample

9 _____

10. In an Algebra 2 class of 28 students, 13 are boys and 15 are girls. On a unit test, 5 boys and 6 girls received a grade of 90-100. If a student is chosen at random from the class, what is the probability of choosing a girl or a student with a grade of 90-100?

- (1) $\frac{21}{28}$ (2) $\frac{20}{28}$ (3) $\frac{15}{28}$ (4) $\frac{26}{28}$

10 _____

11. Which of the following functions is even?

- (1) $f(x) = |x| + 6$ (3) $h(x) = (x + 3)^3$
 (2) $g(x) = -\sin x$ (4) $j(x) = \ln x$

11 _____

Test 4

12. The table gives the value of a computer, in dollars, t years after purchasing the computer. Determine the percent rate of change in the function and whether it represents an exponential growth or decay.

t (years)	1	2	3	4
V (dollars)	2160	1620	1215	911.25

- (1) 75%; exponential decay (3) 25%; exponential growth
 (2) 25%; exponential decay (4) 33%; exponential growth 12 _____

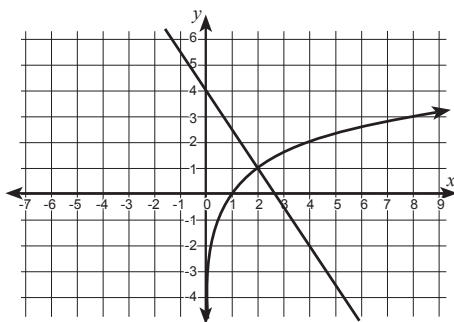
13. A video of a grumpy cat has gone viral. On the first day, the video was viewed 6,000 times. Each day and the number of daily visits is increasing by 40%. Find the cumulative number of views over the first 2 weeks.

- (1) 476,228 views (3) 666,720 views
 (2) 1,651,800 views (4) 1,175,572 views 13 _____

14. Which equation has the same solution as $\frac{x^2}{2} = 5x - 17$?

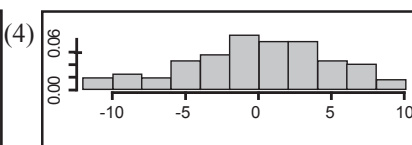
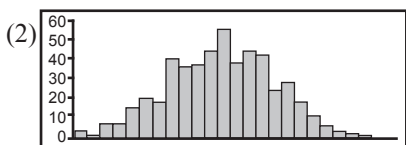
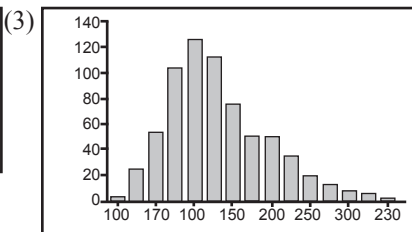
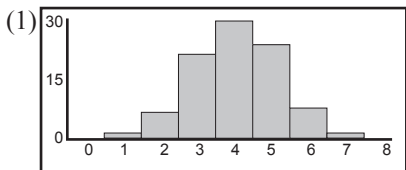
- (1) $(x - 5)^2 = 9$ (3) $x^2 + 10x - 34 = 0$
 (2) $x^2 + 10x + 34 = 0$ (4) $(x - 5)^2 + 9 = 0$ 14 _____

15. Which of the following equations has a solution that is equal to the x -coordinate of the point of intersection of the accompanying graph.



- (1) $\log x = -\frac{3}{2}x + 4$
 (2) $\ln x = -\frac{3}{2}x + 4$
 (3) $\log_2 x = -\frac{3}{2}x + 4$
 (4) $2^x = -\frac{3}{2}x + 4$ 15 _____

16. Which histogram depicts data that is least likely to be approximated by a normal distribution?



Test 4

17. What is the equation of a parabola with a focus of $(8, 2)$ and directrix of $x = 6$?

(1) $4(x - 7) = (y - 2)^2$

(3) $4(x - 2) = (y - 7)^2$

(2) $4(x + 7) = (y + 2)^2$

(4) $4(x + 2) = (y + 7)^2$

17 ____

18. What is the measure, in radians, of an angle that subtends an arc of 3 units on the unit circle?

(1) 3

(2) 6

(3) π

(4) 3π

18 ____

19. An initial population of bacteria grows continuously at a rate of 2.8% per day. What is the population after 48 hours if the initial bacterial population is 180?

(1) 190

(2) 315

(3) 677

(4) 690

19 ____

20. Which of the following is equivalent to $32^{-\frac{4}{5}}$?

(1) $\frac{1}{16}$

(2) No real solution

(3) 16

(4) -16

20 ____

21. Given $m(x) = 4x^3 - 6$, $m^{-1}(x) = ?$

(1) $-4x^3 + 6$

(2) $\sqrt[3]{\frac{x+6}{4}}$

(3) $\frac{1}{4x^3 - 6}$

(4) $\sqrt[3]{4x - 6}$

21 ____

22. When a student is selected at a random from a very large population of high school students, the probability that the student has a smartphone is 0.68, the probability that the student has an electronic tablet is 0.36, and the probability that a student has a smartphone and an electronic tablet is 0.09. Let A be the event that a student has a smartphone and let B be the event that a student has an electronic tablet. Calculate $P(A \text{ given } B)$.

(1) 9%

(2) 13%

(3) 25%

(4) 28%

22 ____

23. Solve for x : $x - \frac{15}{x+3} = \frac{5x}{x+3}$

(1) $\{-3\}$

(2) $\{5\}$

(3) $\{-3, 5\}$

(4) $\{3, -5\}$

23 ____

24. Sasha solved the radical equation, $\sqrt{x-7} = x+1$ using the following steps. In which step did Sasha make an error?

Steps	Work
1	$\sqrt{x-7} = x+1$
2	$(\sqrt{x-7})^2 = (x+1)^2$
3	$x+7 = x^2+1$
4	$x^2-x-6=0$
5	$(x-3)(x+2)=0$
6	$x=3 \quad x=-2$
7	$x=3 \quad x=-2 \quad \text{No Solution}$

(1) Step 5

(2) Step 2

(3) Step 3

(4) Step 4

24 ____

Test 4

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [48]

25. Find the points of intersection of the line, $y = x + 1$ and the circle, $x^2 + y^2 = 25$ algebraically.

26. On a summer day in Cape Cod, the depth of the water at a dock was 4ft at low tide at 2:00 AM. At high tide 5 hours later, the height of the water at the dock rose to 14 feet. Write a cosine function to model the height of the water at the dock x hours after the day began at midnight.

27. Patrick makes wooden figures for a local art studio. It takes him 50 minutes to go to the store to purchase materials for a project and 20 minutes to make each figure.

If he has 5 hours to work, write an absolute value function, $d(x)$, to model the difference between his available time, in minutes, and the time it takes him to finish a job making x figures.

Find the values of x such that $d(x) = 50$. Describe what does $d(x) = 50$ mean in this context?

Test 4

28. The Paper ran a survey which asked readers to call in their responses to this question “Do you support the development of atomic weapons that could kill millions of people?” It was reported that 25 people responded and 92% said no and 8% said yes. Identify three major flaws in this survey. Explain your answer.

29. Use the Remainder Theorem to determine whether $x + 2$ is a factor of $p(x) = x^5 + 2x^4 - 3x^3 - 6x^2 - 6x - 12$. Justify your answer.

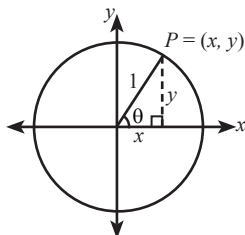
30. Solve the following equation.
Explain each step in the process.

$$-\frac{3}{x} + \frac{5}{2x} = -6$$

31. Complete the table below for $f(x)$ and $g(x)$.

Function	Base b	Growth or decay?	x -intercept	y -intercept	Increasing or decreasing?
$f(x) = 3^x$					
$g(x) = (0.87)^x$					

32. Use the following picture of the unit circle to prove the Pythagorean Identity, $\sin^2\theta + \cos^2\theta = 1$.



Test 4
Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. Devin began running a month ago to get back in shape. The first day he ran .5 miles. Each day after that he ran 10% more than the previous day for a total of 30 days. Use the formula for the sum of a finite geometric series to calculate the total distance Devin ran over the 30 days. Round to *the nearest thousandth* of a mile.

34. Solve $\sqrt{3x+1} = x-1$. Justify your solution(s).

35. The data in the following table represent the club-head speed (of a golf club) and the distance a golf ball travels for eight swings of the club.

x, Club-Head Speed (mph)	100	102	103	101	105	100	99	105
y, Distance (yards)	257	264	274	266	277	263	258	275

Find the linear regression equation that represents this data.

Round to *the nearest hundredth*.

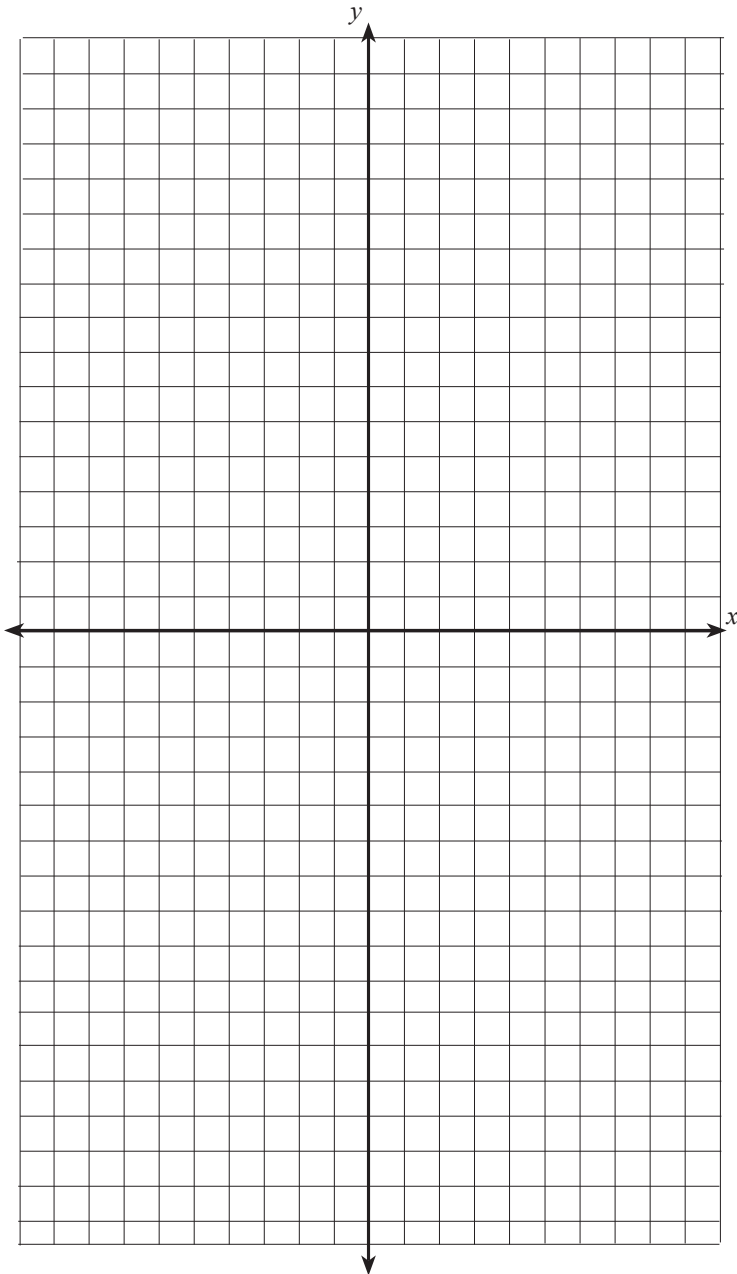
Determine the correlation coefficient for the data set to *the nearest thousandth*.

What does the correlation coefficient tell you about the data?

Test 4

36. Completely factor: $x^3 + x^2 - 9x - 9$

Use your previous answer to sketch a graph of $g(x) = x^3 + x^2 - 9x - 9$ on the grid and label the x -intercepts.



Test 4
Part IV

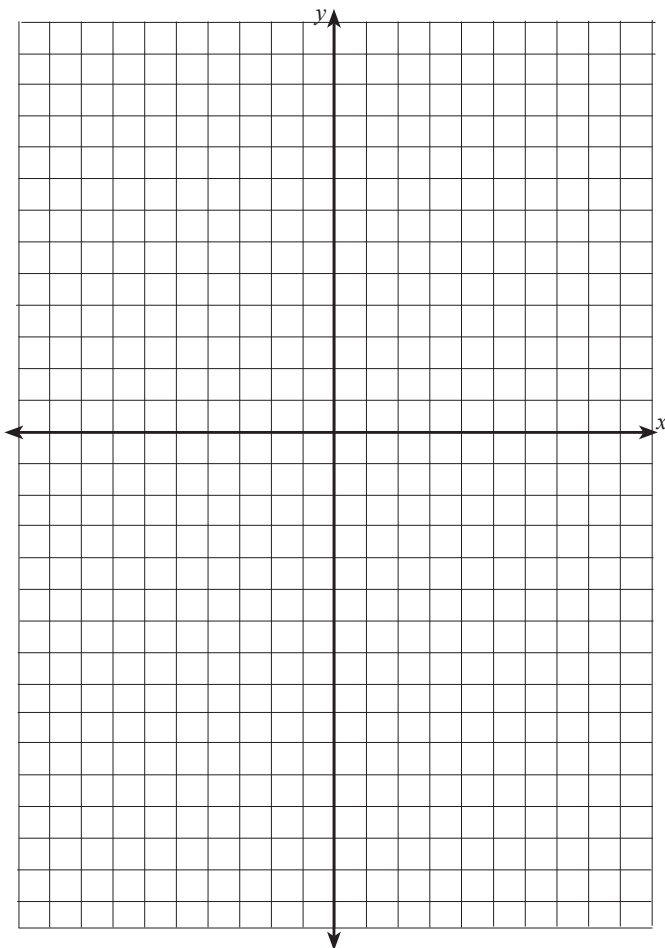
Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37. Let $p(x) = x^3 + 3x^2 - 4x - 12$. Evaluate $p(-2)$, $p(2)$ and $p(-3)$.

What does your answer tell you about the factors of $p(x)$? Explain.

Determine the end behavior of the function.

Graph the polynomial function and label the zeros. Label the relative maxima and minima with coordinates rounded to the *nearest tenth*.



Test 5

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the space provided the numeral preceding the word or expression that best completes the statement or answers the question. [48]

1. Which of the following interest rates is closest to 6.2% interest, compounded annually?

- (1) 6% interest compounded annually
 (2) 6% interest compounded weekly
 (3) 6% interest compounded monthly
 (4) 6% interest compounded daily

1 _____

2. Cobalt has a half-life of 5.2714 years. Therefore, the amount of cobalt left after t years can be modeled by the function $N(t) = N_0 \left(\frac{1}{2}\right)^{\frac{t}{5.2714}}$ where N_0 is the initial amount of cobalt. The amount of cobalt in the sample is decreasing at approximately what rate each year?

- (1) 9% (2) 12% (3) 10% (4) 13%

2 _____

3. Two six sided die are rolled, one after another. In the sample space of all possible results, how many of the sums are not greater than 10?

- (1) 29 (2) 33 (3) 30 (4) 34

3 _____

4. Sweetums finds that the cost of making a certain candy bar is \$0.15 per bar and that fixed costs amount to \$600 per week. If each bar sells for \$1.50, find the minimum number of candy bars that must be sold in a week for the company to make a profit.

- (1) 364 (2) 444 (3) 445 (4) 810

4 _____

5. The number of vacation days used by 15 employees at Chase Titanium Metals Company over the past 2 years are listed below.

2 5 1 0 6 8 4 7 8 0 1 11 3 5 1

What percentage of the scores fall within one standard deviation of the mean for the data set above?

- (1) 12% (2) 67% (3) 87% (4) 80%

5 _____

6. Given the following equations determine the x value(s) that result in an equal output for both functions.

$$f(x) = 3^x$$

$$g(x) = 4x + 1$$

- (1) 9 (2) 1 and 9 (3) 0 and 2 (4) 2

6 _____

7. An asteroid is moving in a parabolic arc that is modeled by the function $p(x) = x^2 - 4x + 9$ where x represents time. A laser is on the path of $f(x) = 2x + 4$. When will the laser first hit the asteroid?

- (1) (0, 9) and (1, 6) (2) (1, 6) and (5, 14) (3) (1, 6) (4) (2, 5)

7 _____

Test 5

8. If the voltage produced by three batteries is $-8 - 11i$ each and the voltage produced by another battery is $6 + 4i$, what is their total voltage?

- (1) 1 (2) $-18 - 7i$ (3) $-2 - 7i$ (4) $-18 - 29i$ 8 _____

9. The vertex of a parabola, $f(x)$, has coordinates $(-3, 5)$. Determine the coordinates of the vertex of the parabola defined by $f(x + 3)$.

- (1) $(-3, 8)$ (2) $(-6, 2)$ (3) $(0, 5)$ (4) $(-6, 5)$ 9 _____

10. If $f(x) = \ln(x + 4) - 8$ and $g(x) = x^3 - 4x^2 + 3x - 5$, what is the greatest solution to the equation $f(x) = g(x)$, rounded to the nearest hundredth?

- (1) -0.37 (2) 2.78 (3) 1.57 (4) 3.55 10 _____

11. In New York State, 38% of the houses have a pool and 21% of the houses have both a pool and hot tub. What is the probability that a house has a hot tub given that it has a pool?

- (1) 8% (2) 59% (3) 55% (4) 108% 11 _____

12. If $p(x) = 2x^3 + cx^2 - 5x - 6$ and $x + 2$ is a factor of $p(x)$, find the value of c .

- (1) -5 (2) -2 (3) 0 (4) 2 12 _____

13. What is the solution of the equation $\frac{2x^2 + 5x - 3}{x^2 + 2x - 3} = 7$?

- (1) $\{ \}$ (2) $\left\{-3, \frac{6}{5}\right\}$ (3) $\{-3\}$ (4) $\left\{\frac{6}{5}\right\}$ 13 _____

14. Jameson collects the following data about the population of his town. Using an exponential regression where x = years after 1950 and y = the population of the town, predict the year in which the population of his town will reach 50,000 people, to the nearest year.

Year	Population
1950	15,600
1960	16,140
1970	18,800
1980	21,790
1990	25,870
2000	29,160
2010	35,980

- (1) 2036 (3) 2044
(2) 2039 (4) 2045 14 _____

15. Which of the following equations has the same solution as $x^2 - 5x + 2 = 0$?

- (1) $\left(x - \frac{5}{2}\right)^2 = -\frac{33}{4}$ (3) $\left(x - \frac{5}{2}\right)^2 = \frac{17}{4}$
(2) $(x - 5)^2 = -27$ (4) $(x - 5)^2 = 23$ 15 _____

16. In which of the following situations would the empirical theoretical be closest to the theoretical probability?

- (1) Rolling a die 20 times (3) Flipping a coin 10 times
(2) Rolling a die 150 times (4) Flipping a coin 75 times 16 _____

Test 5

17. The table below gives the average daily temperatures, in °F, for 12 months that are represented by numbers. (January is month 1, February is 2, etc.)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Temperature	20	25	38	50	63	85	80	90	79	68	48	35

Determine the average rate of change from month 5 to month 11.

- (1) -0.4 (2) 0.4 (3) -2.5 (4) 2.5 17 _____

18. The Smiths want to have four children. What is the probability that they have two boys and two girls in any order?

- (1) $\frac{3}{8}$ (2) $\frac{1}{16}$ (3) $\frac{1}{2}$ (4) $\frac{5}{16}$ 18 _____

19. Which of the following systems of equations has exactly one point of intersection?

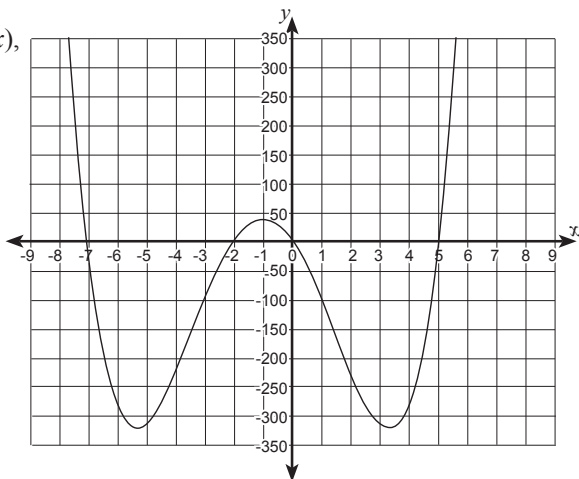
- (1) $y = x^2 - 5x + 7$
 $y - 1 = 2x$ (3) $y - x^2 = 2x + 4$
 $y = 3$
 (2) $y - 4x^2 = y - 3$
 $y = 3$ (4) $y + 9x^2 = -8$
 $y = -1$ 19 _____

20. A ball is dropped from a height of 16 feet. The ball bounces to 70% of its previous height with each bounce. How high (*to the nearest tenth of a foot*) does the ball bounce on the sixth bounce?

- (1) 1.8 feet (2) 1.9 feet (3) 2.7 feet (4) 386.2 feet 20 _____

21. A quartic function, $p(x)$, is graphed to the right. Which of the following is the correct factorization of $p(x)$?

- (1) $(x - 7)(x - 2)(x + 5)$
 (2) $(x + 7)(x + 2)(x - 5)$
 (3) $x(x - 7)(x - 2)(x + 5)$
 (4) $x(x + 7)(x + 2)(x - 5)$



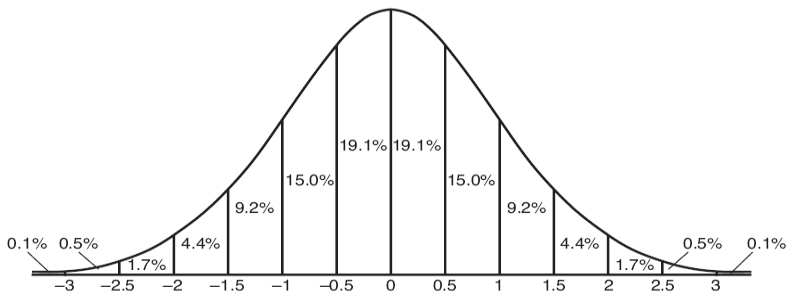
21 _____

22. Rewrite the following expression using fractional exponents: $\sqrt[5]{x^3}$

- (1) $x^{\frac{5}{3}}$ (2) $(x^3)^5$ (3) $x^{\frac{3}{5}}$ (4) $(x^5)^3$ 22 _____

Test 5

23. The hourly wages of working high school students are normally distributed with a mean of \$10.50 per hour and a standard deviation of \$1.25. Use the diagram of the normal distribution below to determine the percent of working high school students who earn between \$8.00 an hour and \$11.75 an hour.



- (1) 53% (2) 68% (3) 82% (4) 95% 23 _____

24. If the focus of a parabola is $(2, 4)$ and the directrix is $y = -2$, find the equation of the parabola.

- (1) $y = \frac{1}{12}(x - 2)^2 + 1$ (3) $y = (x - 2)^2 + 1$
 (2) $y = \frac{1}{4}(x - 2)^2 + 1$ (4) $x = \frac{1}{2}(y - 4)^2$ 24 _____

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25. Express $i^4 + 2i^3 + 3i^2 + 4i$ in simplest $a + bi$ form.

26. How could the following observational study be converted into a controlled experiment? Jennifer goes to a basketball clinic every Tuesday. She is watching fifth grade athletes with the goal of determining if the amount of time they spend practice shooting before the clinic has an impact on the number of shots they make in the game at the end of the clinic.

Test 5

27. The cost of tuition at a university is \$26,000 per year. Tuition is projected to increase by 2% per year. Write an equation that represents the projected tuition t years from now.

28. According to recent reports in 2010, 74.7% of students graduate from high school. 62.5% of students go directly to college given that they had graduated from high school. Based on these statistics, what percent of the total high school population goes directly to college? Round your answer to the nearest *tenth of a percent*.

29. At the age of 15, Sarah gets a weekly allowance of \$35. She also makes \$13.75 an hour at her job where she works 20 hours a week. Each year her parents raise her allowance \$5 and her employer raises her hourly pay by 4%. Assuming she continues to work 20 hours a week, write a function to model the amount of money Sarah will be making x years after she was 15.

30. Does the equation $\frac{4x}{x-3} = 8 + \frac{12}{x-3}$ have any extraneous solutions? Explain.

Test 5

31. If $h(x) = \frac{x-4}{x+5}$ find $h^{-1}(x)$.

32. A game spinner is numbered 1-12. What is the probability that Keith spins and he lands on an odd number and then Julie spins and lands on a multiple of 4? Are these independent or dependent events? Justify your answer.

Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. The following set of data shows U. S. gas prices in recent years.

Based on the table what was the average rate of change in the price of gasoline from 2005 to 2014, to the nearest thousandth? Use appropriate units for your answer.

What is the exponential regression for the data in the table, rounding coefficients to the nearest thousandth. Use $x = 1$ for the year 2005.

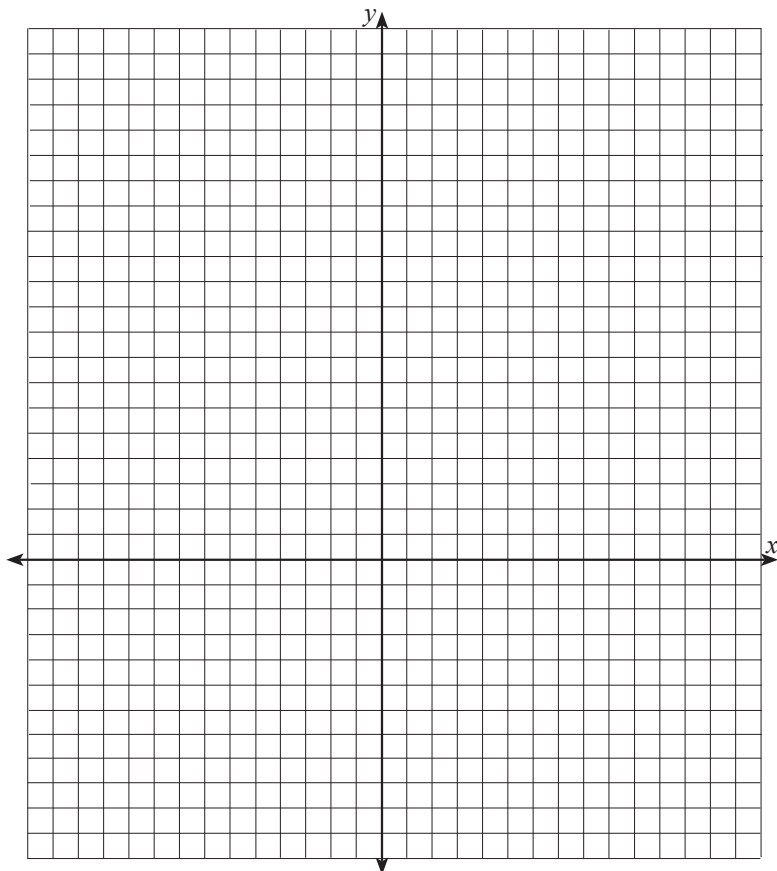
Year	Price (\$)
2005	1.78
2006	2.24
2007	2.33
2008	3.11
2009	1.68
2010	2.67
2011	3.07
2012	3.29
2013	3.29
2014	3.33

Based upon your regression, what is the average rate of change in the price of gasoline from 2005 to 2014, to the nearest thousandth? Use appropriate units for your answer.

Why is there a difference between your answers using the table and using the regression equation?

Test 5

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



35. In his first year at his job, Kyle made \$12.50 per hour. In his second year at his job, Kyle made \$13.00 per hour.

Assuming Kyle's wages increase by the same dollar amount each year, write an explicit formula for an arithmetic sequence which models the number of dollars, n , that Kyle makes per hour each year.

Assuming Kyle's wages increase by the same percent each year, write an explicit formula for a geometric sequence which models the number of dollars, n , that Kyle makes per hour each year.

If Kyle made \$14.62 in his fifth year at the job, which formula best models his hourly rate each year? Justify your answer.

Test 5

36. Solve $x^2 + 10 = -6x$ by the quadratic formula and completing the square.

Explain how the two methods are related.

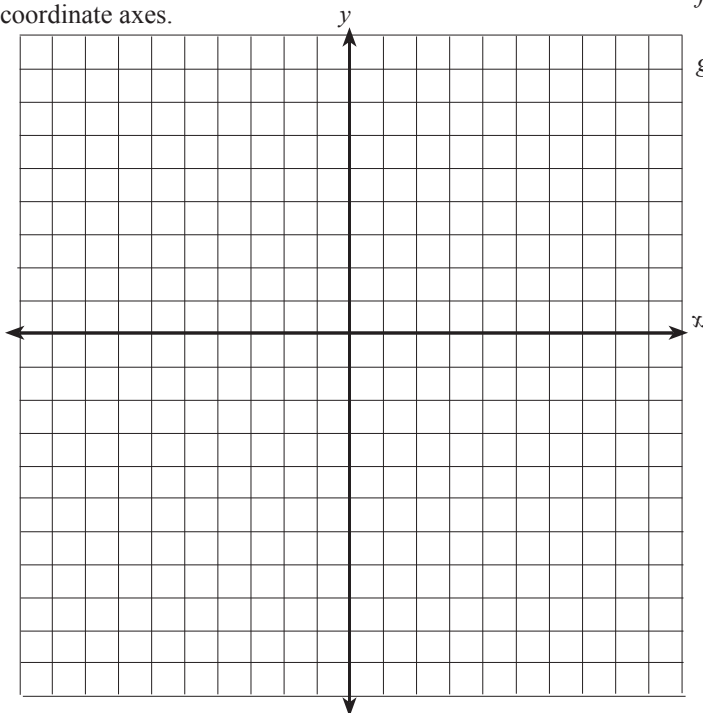
Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37. Sketch the graph of this pair of functions on the same coordinate axes.

$$f(x) = \left(\frac{1}{2}\right)^x$$

$$g(x) = -\left(\frac{1}{2}\right)^{x+4}$$



Describe the graph of $g(x)$ as a series of transformations on the graph of $f(x)$. Identify the intercepts and describe the end behaviors of $f(x)$ and of $g(x)$.

Test 6
Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the space provided the numeral preceding the word or expression that best completes the statement or answers the question. [48]

1. The table below shows the results of a survey in which young adults ages 18-24 were asked if they ever used Instashop (Yes or No). Use the table to answer the question.

	Female	Male
Has Used Instashop	216	172
Has Never Used Instashop	54	68

Find the probability that a randomly selected young adult who is female has used Instashop. Also indicate whether or not it is a conditional probability.

- (1) 80% and it is a conditional probability
 (2) 42% and it is a conditional probability
 (3) 87% and it is not a conditional probability
 (4) 80% and it is not a conditional probability
- 1 _____

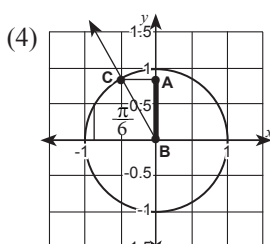
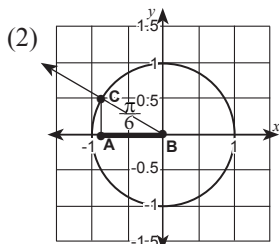
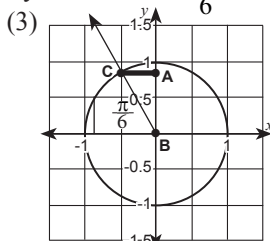
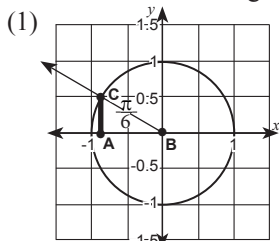
2. Which of the following formulas is equivalent to the geometric sequence modeled by the equation $a_n = 5(2)^{n-1}$?

- (1) $a_1 = 5, a_{n+1} = 2a_n$ (3) $a_1 = 10, a_{n+1} = 2a_n$
 (2) $a_1 = 2, a_{n+1} = 5a_n$ (4) $a_1 = 5, a_{n+1} = (a_n)^2$
- 2 _____

3. Hailey's father has been painting houses for the past 20 years. As a result he can paint a house 1.5 times faster than Hailey can. They work together on a house painting project, and it takes them 14 hours. How many hours, to the nearest hour, would it have taken Hailey if she had been working alone?

- (1) 21 (2) 35 (3) 23 (4) 42
- 3 _____

4. Which bold line segment correctly identifies $\sin \frac{5\pi}{6}$?



4 _____

Test 6

5. Which of the following functions has a factor of $(x + 2)$?

(1) $f(x) = x^3 - 4x^2 - 5$

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

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

(4) $f(x) = 2x^3 + x^2 - 4x + 4$

5 _____

6. The number, n (in thousands), of people in a town from 2000 to 2006 can be approximated by the quadratic function

$$n(t) = 1.393t^2 + 12.029t + 111.293, \text{ where } t = 0 \text{ corresponds to 2000.}$$

Use the model to predict the year when there are 300,000 people in the town.

(1) 2008

(2) 2009

(3) 2459

(4) 2460

6 _____

7. The probability of someone having brown eyes is 65%. If two different people are chosen what is the probability that neither person has brown eyes.

(1) 0.4225

(2) 0.2025

(3) 0.1225

(4) 0.2275

7 _____

8. In July, Kira was filling a small pool with the hose. Below is a table that represents the number of gallons, g , of water in the pool after t hours.

t , hours	1	3	4	6
g , gallons	40	120	160	220

Find the average rate of change for the number of gallons from $t = 4$ to $t = 6$.

(1) 30 gallons/hour

(3) 60 gallons/hour

(2) 40 gallons/hour

(4) 80 gallons/hour

8 _____

9. The two largest predictors of juvenile delinquency are a negative parenting style (too lenient or too disciplinary) and a negative peer group association (friends who are delinquent). If 35% of children have parents who use a negative parenting style, 16% of children have a negative peer group association, and 8% of children experience both a negative parenting style and a negative peer group association, what percent of children experience a negative parenting style or a negative peer group association?

(1) 59%

(2) 51%

(3) 43%

(4) 27%

9 _____

10. Which of the following is equivalent to $-4\sqrt{-48}$ in simplest form?

(1) $8\sqrt{12}$ (2) $16\sqrt{3}$ (3) $-8i\sqrt{12}$ (4) $-16i\sqrt{3}$

10 _____

11. Find the rate of growth to the nearest ten-thousandth for the amount of money accumulated if \$6,000 is invested at 8% interest compounded quarterly.

(1) .0824

(2) .9800

(3) .0200

(4) 1.0824

11 _____

12. A large city has a current population of 500,000 people which is decreasing continuously at a rate of 4.5% each year. Which logarithm is equal to the number of years it will take for the population to decrease to half of the current population?

(1) $\frac{\ln .5}{.045}$ (2) $\frac{\ln .5}{-.045}$ (3) $\frac{\log (.5)}{.045}$ (4) $\frac{\log .5}{-.045}$

12 _____

Test 6

13. What are the focus and directrix of the parabola represented by the equation: $8(y - 6) = (x + 2)^2$?

- | | | |
|---------------------|--------------------|---------|
| (1) Focus: (0, 6) | (3) Focus: (-2, 4) | |
| Directrix: $x = -4$ | Directrix: $y = 8$ | |
| (2) Focus: (-2, 8) | (4) Focus: (-2, 6) | |
| Directrix: $y = 4$ | Directrix: $y = 4$ | 13 ____ |

14. If $f(x) = 3(5)^x$, determine the coordinates of the y -intercept of the function defined by $f(x) + 4$.

- | | | | | |
|------------|------------|------------|------------|---------|
| (1) (0, 9) | (2) (7, 0) | (3) (0, 7) | (4) (0, 5) | 14 ____ |
|------------|------------|------------|------------|---------|

15. Which sine function has a period of 8π , a midline of $y = 3$ and an amplitude of 2?

- | | | |
|---|---|---------|
| (1) $f(x) = 2\sin(8x) + 3$ | (3) $f(x) = 2\sin\left(\frac{1}{2}x\right) + 3$ | |
| (2) $f(x) = 3\sin\left(\frac{1}{4}x\right) + 2$ | (4) $f(x) = 2\sin\left(\frac{1}{4}x\right) + 3$ | 15 ____ |

16. Electrical Engineers find the voltage, E , produced by a battery by finding the product of the impedance, I , and the current, Z . $E = I \cdot Z$ where E represents the voltage, I represents the impedance, and Z represents the current. What is the voltage if the impedance is $4 + 8i$ and the current is $2 - 3i$?

- | | | | | |
|---------------|----------------|----------------|---------------|---------|
| (1) $32 + 4i$ | (2) $32 + 28i$ | (3) $-16 + 4i$ | (4) $8 - 20i$ | 16 ____ |
|---------------|----------------|----------------|---------------|---------|

17. What are the zeroes of $2(x + 6)(x - 3)(x - 3)(x + 4)$?

- | | | | | |
|---------------|-----------|-----------|------------------|---------|
| (1) -6, -4, 3 | (2) -3, 8 | (3) -8, 3 | (4) 6, 4, -3, -3 | 17 ____ |
|---------------|-----------|-----------|------------------|---------|

18. 12% of U.S. homes own a MAC computer and 72% of U.S. homes own at least two flat screen televisions. If the two events are independent, what is the probability of owning a MAC computer and owning at least two flat screen televisions?

- | | | | | |
|--------|---------|---------|---------|---------|
| (1) 9% | (2) 60% | (3) 17% | (4) 94% | 18 ____ |
|--------|---------|---------|---------|---------|

19. Almost all high school students who intend to go to college take the SAT test. In a recent test, the mean SAT score (in verbal and mathematics) of all students was 1020. Maylin is planning to take this test soon. Suppose the SAT scores of all students who take this test with Maylin will have a normal distribution with a mean of 1020 and a standard deviation of 153. What is the minimum score she can get on the SAT to be in the top 10% of the examinees?

- | | | | | |
|----------|----------|----------|----------|---------|
| (1) 1173 | (2) 1216 | (3) 1326 | (4) 1479 | 19 ____ |
|----------|----------|----------|----------|---------|

20. In which of the following situations is the sample mean not a valid estimate of the population mean?

- | | | |
|--|--|---------|
| (1) 100 students sampled
1000 in population | (3) 50 students sampled
500 in population | |
| (2) 100 students sampled
500 in population | (4) 50 students sampled
1,000 in population | 20 ____ |

Test 6

21. Solve for y in the following equation: $\sqrt{4-2y-y^2} - 2 = y$.

- (1) { } (2) {-3} (3) {0} (4) {-3, 0} 21 _____

22. Find the inverse $g(x)$ for the function: $f(x) = \frac{(x+5)}{(x-2)}$

- (1) $g(x) = \frac{2x+5}{x-1}$ (3) $g(x) = \frac{x-2}{x+5}$
 (2) $g(x) = \frac{2x+5}{x+1}$ (4) $g(x) = \frac{y+5}{y-2}$ 22 _____

23. The function j is defined by $j(x) = (8x)^{\frac{1}{2}}$. The function k is defined by $k(x) = \sqrt[3]{x}$. If $f(x) = j(2x)k(8x)$, which of the following expressions is equal to $f(x)$?

- (1) $8x^{\frac{1}{3}}$ (2) $8x^{\frac{5}{6}}$ (3) $16x^{\frac{1}{3}}$ (4) $16x^{\frac{5}{6}}$ 23 _____

24. Kendra and Jeremy are playing a game with four dice, each numbered 1 through 6. The dice may or may not be unfairly weighted where one outcome is more likely than another. A person automatically wins the game if they roll all four dice and the sum is 22 or greater. On Kendra's first roll, the sum of the four dice is 23, so she automatically won the game. Jeremy goes home and uses a simulation program he finds online to decide if the dice were weighted. The results of this simulation of 200 4-dice rolls are summarized in the table. Which of the following conclusions is most valid?

- (1) The dice have to be weighted because only 2 of the 200 trials resulted in a sum of 22 or higher.
 (2) The dice are not weighted. It just happened by chance.
 (3) The dice are most likely weighted because only 2 of the 200 trials resulted in a sum of 22 or higher.
 (4) The dice may be weighted, but simulations are not helpful to answer the question.

Sum of 4 Dice	Number of Trials
4	0
5	2
6	3
7	2
8	9
9	8
10	9
11	19
12	15
13	24
14	19
5	21
16	19
17	23
18	9
19	8
20	4
21	4
22	1
23	0
24	1

24 _____

Test 6
Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25. What is the solution to the system of linear equations?
- $$\begin{aligned}x - 2y + 3z &= 7 \\2x + y + z &= 4 \\-3x + 2y - 2z &= -10\end{aligned}$$

26. Find a polynomial function of degree 3 in standard form which has the corresponding table of values.

x	y
4	18
3	0
2	-4
1	0
0	6
-1	8
-2	0
-3	-24
-4	-70

27. Use the graph of $f(x) = x^3 - 6x^2 + 11x - 6$ to rewrite $f(x)$ as a product of a linear factors.

28. Jerry has a gift card for \$25. He plans to purchase 2 songs per week using the gift card. After he purchases one song, he has \$23.71 left on his gift card. After he purchases two more songs, he has \$21.13 left on the gift card.

Assuming each song that he purchases costs the same amount, write an equation to define $M(s)$, the amount of money left on the gift card after s song purchases.

For how many weeks can he purchase 2 songs for using only his gift card? Explain how you arrived at your answer.

Test 6

29. The table below shows the results of a survey in which students in 11th grade were asked if they participated in a sport. Use the table to answer the question.

	Female	Male
Participates in a School Sport	85	165
Does not Participate in a School Sport	255	495

- a) Determine if randomly selecting a male student and randomly selecting a student who participates in sports are independent events and justify your answer.
- b) Find the probability that a randomly selected 11th grader who is female does not participate in a school sport. Indicate if the probability is conditional or unconditional and explain why.

30. The recursive formula, $a_2 = 18.5$, $a_n = a_{n-1} + 1.5$ models the number of people, in millions, that own a smartphone in the U.S., n years after 2014.

Write an equivalent explicit formula for the situation.

Find the value of a_5 using both the recursive formula and the explicit formula. Explain what a_5 means in the context of the problem.

Test 6

31. Lincoln conducts an experiment to determine if studying for an hour impacts the number of questions correct on the learner's permit (driving) test. He randomly assigns the students in his homeroom who have not yet taken the test to two groups. Group *A* agrees to study for an hour before taking the permit test. Group *B* agrees to take the test without studying. The number of questions each student answered correctly is recorded in the table below.

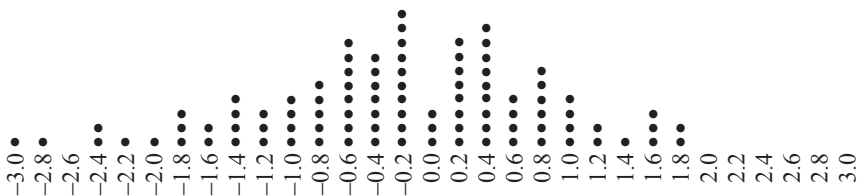
Note: There are 20 total questions on the test.

Group A	
Student	Number Correct
1	16
2	19
3	20
4	17
5	15
6	19
7	18
8	14
9	14
10	20

Group B	
Student	Number Correct
11	14
12	17
13	18
14	15
15	19
16	14
17	12
18	16
19	18
20	15

Find the sample mean for each group and the difference between the sample means.

To decide if the difference between the sample means is significant, Lincoln takes the 20 data values for the number of questions correct on the test, and randomly assigns them to two groups. He finds the mean of the two groups and their difference. Lincoln repeats this process 100 times. The dot plot below displays the difference between the means for each of the 100 trials of the simulation.



- Based on the dot plot, is the difference in sample means between Group *A* and Group *B* significant? Why or why not?
- Lincoln still believes that there is a significant difference between the group that studied and the one that did not. If he wants to redo the experiment, what could he do to increase his chances of finding a significant difference if there is one?

Test 6

32. A gymnast is practicing giants on a high bar. This is a move in which a body goes in a full circle around the bar while he is holding the bar with arms extended. If a gymnast does a series of giants in a row at a constant pace, the distance his feet are above the ground at a given time, t , can be modeled by the equation,

$$f(x) = -85 \cos\left(\frac{8\pi}{5}t\right) + 109$$

What is the period of this function?

What is the midline of this function?

What are the minimum and maximum values of the function?

Based on your answers to parts (b) and (c), determine what unit of distance is being used for $s(t)$: centimeters, inches, or feet. What unit of time is used?

Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. Factor the expression $x^3 - 6x^2 - 4x + 24$ and explain how your answer can be used to solve the equation $x^3 - 6x^2 - 4x + 24 = 0$.

Explain why the solutions to this equation are the same as the x -intercepts of the graph of the function $f(x) = x^3 - 6x^2 - 4x + 24$.

Test 6

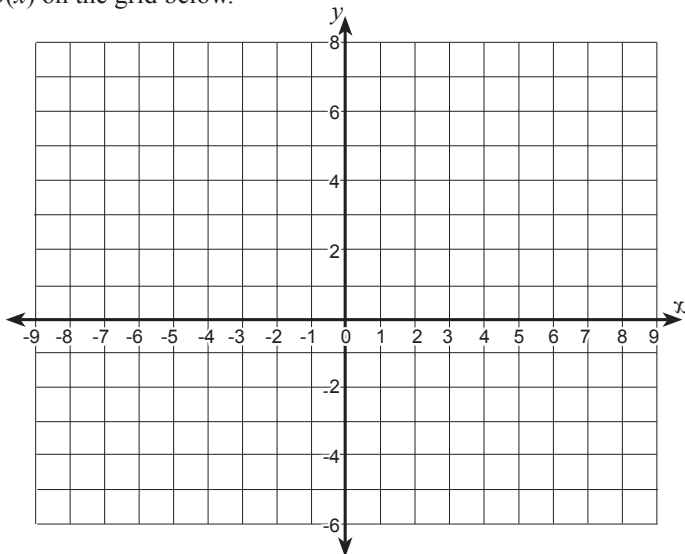
34. The population of a large town in upstate New York was 19,413 people in the year 2015. The population is increasing according to the following formula: $P = 19413(96)^{-4t}$ where P is the population of the town t years after 2015.

The above equation can be written in the form $P = 19413(x)^t$. What is the value of x , to the *nearest thousandth*?

If the population growth is compounded annually, what is the rate of growth, to the *nearest tenth of a percent*?

Using the original formula, what was the average rate of change in the population from 2015 to 2020 to the *nearest whole number*? Use appropriate units to label your answer

35. p is defined such that $p(x) = \begin{cases} |3x + 7| & \text{for } x \leq -1 \\ 5(2)^{-x} - 6 & \text{for } x > -1 \end{cases}$
Graph $p(x)$ on the grid below.



Where does $p(x)$ have a relative maximum?

Over what interval(s) is $p(x)$ decreasing?

What is the end behavior of $p(x)$ as x approaches infinity?

Test 6

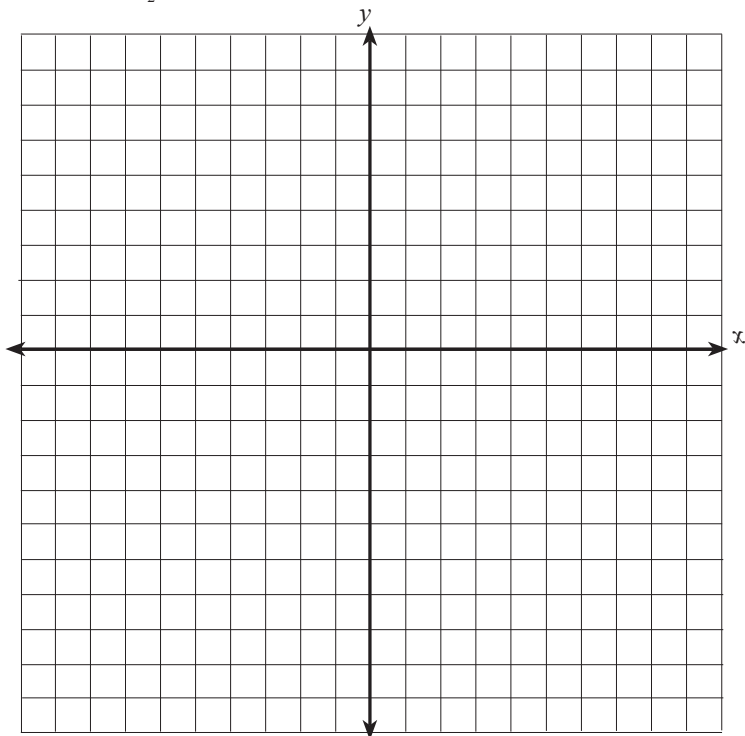
36. Prove that $(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$ is an identity.

Use the identity to simplify $(2a - 3)^3$.

Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37. Graph $h(x) = \log_2(x + 8)$. What is the product of the x and y intercepts of $h(x)$?



ALGEBRA 2 COMMON CORE

Correlation of Standards

QUESTION	STANDARD		
	TEST 1	TEST 2	TEST 3
1	N.CN.1	A.SSE.2	F.IF.3
2	S.CP.1	F.TF.1	S.CP.3
3	N.RN.1	A.CED.1	S.IC.3
4	S.CP.2	A.SSE.4	N.RN.2
5	F.IF.8	S.IC.1	A.REI.2
6	A.REI.7	S.CP.7	A.REI.7
7	N.CN.7	N.CN.7	F.IF.9
8	F.BF.3	N.RN.1	S.ID.4
9	N.Q.2	S.IC.3	F.TF.8
10	F.TF.2	S.IC.6	N.CN.1
11	A.SSE.2	A.APR.2	A.REI.6
12	F.BF.1	F.IF.6	F.LE.5
13	A.APR.4	F.BF.3	S.CP.3
14	S.IC.4	S.CP.1	A.REI.4
15	A.CED.1	A.SSE.4	F.LE.4
16	S.CP.6	A.APR.6	S.ID.6
17	N.CN.7	S.ID.4	S.CP.1
18	S.CP.2	F.TF.5	A.APR.6
19	F.IF.7	S.CP.4	A.REI.1
20	S.IC.2	F.BF.2	A.APR.2
21	F.IF.4	F.LE.2	N.CN.2
22	G.GPE.2	S.CP.2	F.BF.2
23	F.IF.8	F.BF.1	F.BF.4
24	F.IF.9	F.IF.4	S.ID.6

QUESTION	STANDARD		
	TEST 1	TEST 2	TEST 3
25	A.SSE.4	N.CN.2	F.LE.2
26	A.REI.4	F.BF.4	A.APR.6
27	S.IC.6	F.LE.2	A.SSE.2
28	F.LE.5	N.RN.1	A.REI.4
29	S.IC.5	S.IC.1	F.IF.4
30	A.APR.3	F.IF.7	N.CN.2
31	F.IF.8	F.IF.7	F.IF.6
32	A.REI.1	A.REI.4	S.CP.4
33	S.ID.6	S.IC.4	A.REI.1
34	F.TF.2	A.REI.6	F.IF.7
35	S.CP.4	A.REI.1	F.BF.3
36	A.APR.6	A.APR.4	F.IF.4
37	F.IF.7	F.IF.7	S.ID.6

QUESTION	STANDARD		
	TEST 4	TEST 5	TEST 6
1	F.BF.3	A.SSE.3	S.CP.4
2	N.RN.2	F.IF.8	F.IF.3
3	A.REI.4	S.CP.1	A.CED.1
4	S.CP.4	A.CED.1	F.TF.2
5	N.CN.2	S.ID.4	A.APR.2
6	S.IC.3	A.REI.11	A.REI.4
7	F.BF.1	A.REI.7	S.CP.2
8	A.CED.1	N.CN.2	F.IF.6
9	S.IC.1	F.BF.3	S.CP.7
10	S.CP.7	A.REI.11	N.CN.1
11	F.BF.3	S.CP.3	F.IF.8
12	F.IF.8	A.APR.2	F.LE.4
13	F.BF.2	A.REI.2	G.GPE.2
14	N.CN.7	S.ID.6	F.BF.3
15	F.LE.4	A.REI.4	F.TF.3
16	S.ID.4	S.IC.2	N.CN.2
17	G.GPE.2	F.IF.6	A.APR.3
18	F.TF.1	S.CP.7	S.CP.5
19	S.ID.6	A.REI.7	S.ID.4
20	N.RN.2	F.BF.2	S.IC.4
21	F.BF.4	A.APR.3	A.REI.2
22	S.CP.5	N.RN.2	F.BF.4
23	A.REI.2	S.ID.4	F.BF.1
24	A.REI.1	G.GPE.2	S.IC.2

QUESTION	STANDARD		
	TEST 4	TEST 5	TEST 6
25	A.REI.7	N.CN.1	A.REI.6
26	F.TF.5	S.IC.3	S.ID.6
27	A.CED.1	F.LE.2	A.SSE.2
28	S.IC.6	S.CP.5	F.BF.1
29	A.APR.2	F.BF.1	S.CP.4
30	A.REI.1	A.REI.2	F.BF.2
31	F.IF.7	F.BF.4	S.IC.5
32	F.TF.8	S.CP.2	N.Q.2
33	A.SSE.4	F.IF.6	A.APR.3
34	A.REI.2	A.APR.3	A.SSE.3
35	S.ID.6	F.LE.2	F.IF.4
36	A.APR.3	A.REI.4	A.APR.4
37	F.IF.7	F.IF.7	F.IF.7

STANDARD	TEST 1	TEST 2	TEST 3
A.APR.2			
A.APR.3	30		
A.APR.4	13	36	
A.APR.6	36	16	18, 26
A.CED.1	15	3	
A.REI.1	32	35	
A.REI.2			5
A.REI.4	26	32	14, 28
A.REI.6		34	11
A.REI.7	6		6
A.REI.11			19, 33
A.SSE.2	11	1	27
A.SSE.3	33		
A.SSE.4	25	4	
F.BF.1	12	23	
F.BF.2		20	22
F.BF.3	8	13	35
F.BF.4		26	23
F.IF.3			1
F.IF.4	21	24	29, 36
F.IF.6		12	31
F.IF.7	19, 37	30, 31, 37	34
F.IF.8	5, 31		
F.IF.9	24		7
F.LE.2		21, 27	25
F.LE.4			15
F.LE.5	28		12

STANDARD	TEST 4	TEST 5	TEST 6
A.APR.2	29	12	5
A.APR.3	36	21, 34	33, 17
A.APR.4			36
A.APR.6			
A.CED.1	8, 27	4	3
A.REI.1	24, 30		
A.REI.2	23, 34	13, 30	21
A.REI.4	3	15, 36	6
A.REI.6			25
A.REI.7	25	7, 19	
A.REI.11	15	6, 10	
A.SSE.2			27
A.SSE.3		1	34
A.SSE.4	33		
F.BF.1	7	29	23
F.BF.2	13	20	30
F.BF.3	1, 11	9	14
F.BF.4	21	31	22
F.IF.3			2
F.IF.4			35
F.IF.6		17, 33	8
F.IF.7	31, 37	37	37
F.IF.8	12	2	11
F.IF.9			
F.LE.2		27, 35	
F.LE.4			12
F.LE.5			

STANDARD	TEST 1	TEST 2	TEST 3
F.TF.1		2	
F.TF.2	10, 34		
F.TF.3			
F.TF.5		18	
F.TF.8			9
G.GPE.2	22		
N.CN.1	1		10
N.CN.2		25	21, 30
N.CN.7	7, 17	7	
N.Q.2	9		
N.RN.1	3	8, 28	
N.RN.2	23		4
S.CP.1	2	14	17
S.CP.2	4, 18	22	
S.CP.3			2, 13
S.CP.4	35	19	32
S.CP.5			
S.CP.6	16		
S.CP.7		6	
S.IC.1		5, 29	
S.IC.2	20		
S.IC.3		9	3
S.IC.4	14	33	
S.IC.5	29		
S.IC.6	27	10	
S.ID.4		17	8
S.ID.6	33		16, 24, 37

STANDARD	TEST 4	TEST 5	TEST 6
F.TF.1	18		
F.TF.2			4
F.TF.3			15
F.TF.5	26		
F.TF.8	32		
G.GPE.2	17	24	13
N.CN.1		25	10
N.CN.2	5	8	16
N.CN.7	14		
N.Q.2			32
N.RN.1			
N.RN.2	2, 20	22	
S.CP.1		3	
S.CP.2		32	7
S.CP.3		11	
S.CP.4	4		1, 29
S.CP.5	22	28	18
S.CP.6			
S.CP.7	10	18	9
S.IC.1	9		
S.IC.2		16	24
S.IC.3	6	26	
S.IC.4			20
S.IC.5			31
S.IC.6	28		
S.ID.4	16	5, 23	19
S.ID.6	19, 35	14	6

