

MATHEMATICS TEST—NO CALCULATOR

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

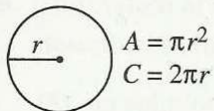
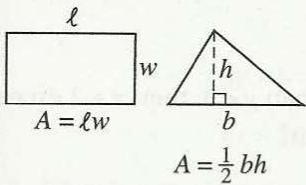
Directions: For questions 1-15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16-20, solve the problem and fill in the answer on the answer sheet grid.

Notes:

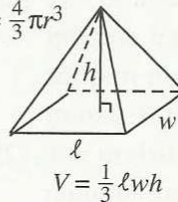
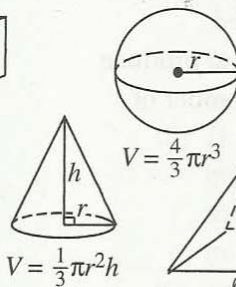
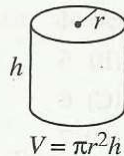
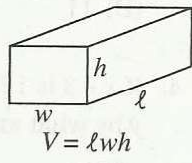
- Calculators are **NOT PERMITTED** in this section.
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- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

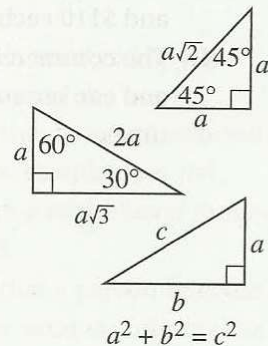
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360° .
 The arc of a circle contains 2π radians.
 The sum of the measures of the angles in a triangle is 180° .

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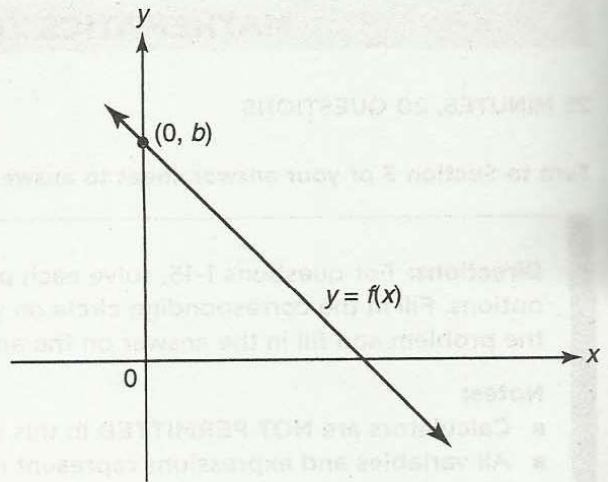
1. If $x^{-2} = 64$, what is the value of $x^{\frac{1}{3}}$?

- (A) $\frac{1}{8}$
- (B) $\frac{1}{4}$
- (C) $\frac{1}{2}$
- (D) 2

$$C(n) = 110n + 900$$

2. The cost of airing a commercial on television, C , is modeled by the function above where n is the number of times the commercial is aired. Based on this model, which statement is true?

- (A) The commercial costs \$0 to produce and \$110 per airing up to \$900.
- (B) The commercial costs \$110 to produce and \$900 each time it is aired.
- (C) The commercial costs \$900 to produce and \$110 each time it is aired.
- (D) The commercial costs \$110 to produce and can air an unlimited number of times.



Note: Figure not drawn to scale.

3. The figure above shows the graph of the linear function $y = f(x)$. If the slope of the line is -2 and $f(3) = 4$, what is the value of b ?

- (A) 8
- (B) 9
- (C) 10
- (D) 11

4. If $x - 3$ is 1 less than $y + 3$, then $x + 2$ exceeds y by what amount?

- (A) 4
- (B) 5
- (C) 6
- (D) 7

5. The weights of 5 boxes of screws vary from 2.85 pounds to 3.45 pounds. If w represents the weight, in pounds, of one of these boxes, which of the following must be true?

- (A) $|w - 2.85| \leq 0.3$
- (B) $|w - 3.15| \leq 0.3$
- (C) $|w - 5| \leq 0.3$
- (D) $|w - 0.3| \leq 3.15$

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6. Mikala exercises in her gym by jogging on the treadmill at an average rate of 4 miles per hour and then pedaling on a stationary bicycle at an average rate of 8 miles per hour. In her workout, she jogs the equivalent of x miles and bicycles the equivalent of y miles. If Mikala works out for at least 45 minutes, which of the following is true?

- (A) $\frac{x}{4} + \frac{y}{8} \geq \frac{3}{4}$
 (B) $x + \frac{y}{2} \geq \frac{3}{4}$
 (C) $4x + 8y \geq 45$
 (D) $\frac{4}{x} + \frac{8}{y} \geq 45$

7. If $7^k = 100$, what is the value of $7^{\frac{k}{2}+1}$?

- (A) 18
 (B) 51
 (C) 57
 (D) 70

$$3y + 6 = 2x$$

$$2y - 3x = 6$$

8. The system of equations above can best be described as having

- (A) no solution.
 (B) one solution with the graphs intersecting at right angles in the xy -plane.
 (C) one solution with the graphs *not* intersecting at right angles in the xy -plane.
 (D) infinitely many solutions.

9. Which of the following statements is true about the parabola whose equation in the xy -plane is $y = (2x - 6)(x + 1)$?

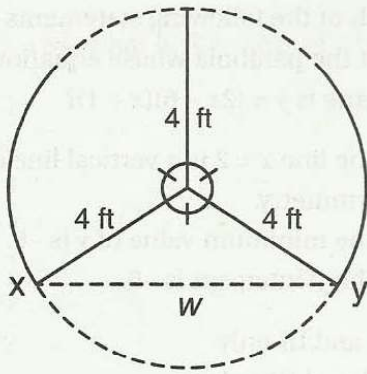
- I. The line $x = 2$ is a vertical line of symmetry.
 II. The minimum value of y is -8 .
 III. The y -intercept is -6 .

- (A) I and III only
 (B) II and III only
 (C) I and II only
 (D) I, II, and III

10. A survey is conducted in which 60% of the individuals who responded indicated that they do *not* support issuing a bond to help raise money to fund the construction of a new sports arena in their city. A statistician calculates the confidence level to be 95% for an interval of 5% below and above the 60% mark. What conclusion is best supported by this information?

- (A) 95% of the people surveyed do *not* support the issuing of the bond.
 (B) The probability that a person selected at random from the sample does *not* support the issuing of the bond ranges from 0.57 to 0.63.
 (C) The probability that a person selected at random from the sample supports the issuing of the bond is 0.4.
 (D) If the survey were to be repeated 100 times, 95% of the time the number of people who would *not* support the issuing of the bond would range from 55% to 65% of those surveyed.

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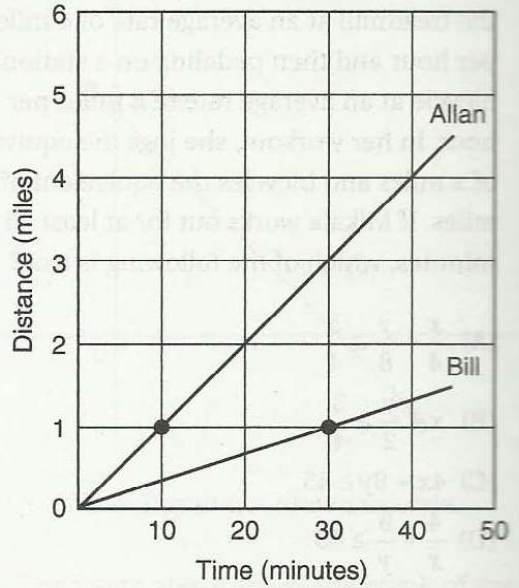
11. The accompanying diagram shows a revolving door with three panels, each of which is 4 feet long. What is the number of feet in the width, w , of the opening between points x and y ?

- (A) $\frac{4}{\sqrt{3}}$
- (B) $4\sqrt{3}$
- (C) $8\sqrt{2}$
- (D) $8\sqrt{3}$

12. Impedance measures the opposition of an electrical circuit to the flow of electricity. The total impedance in a particular circuit is given by the formula $Z_T = \frac{Z_1 \cdot Z_2}{Z_1 + Z_2}$. What is the total impedance of a circuit, Z_T , if $Z_1 = 1 + 2i$ and $Z_2 = 1 - 2i$? [Note: $i = \sqrt{-1}$]

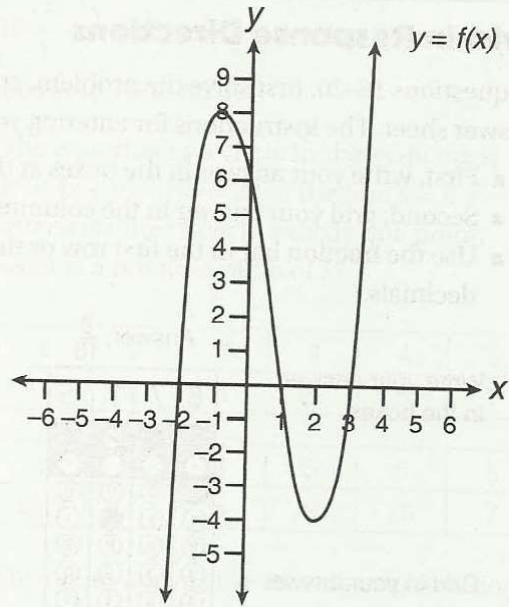
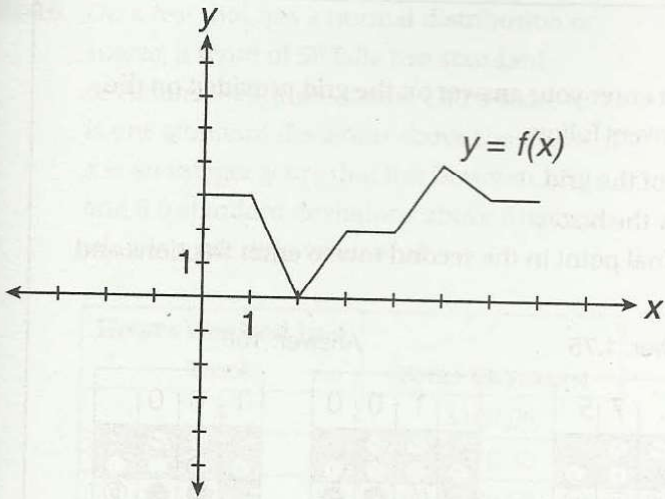
- (A) $-\frac{3}{2}$
- (B) $2i$
- (C) $\frac{1}{2}$
- (D) $\frac{5}{2}$

Exercise



13. At 9:00 A.M. Allan began jogging and Bill began walking at constant rates around the same circular $\frac{1}{4}$ mile track. The figure above compares their times in minutes and corresponding distances in miles. Which statement or statements must be true?
- I. Bill's average rate of walking was 2 miles per hour.
 - II. At 9:10 A.M., Allan had jogged $\frac{3}{5}$ mile more than Bill had walked.
 - III. At 9:30 A.M., Allan had completed 8 more laps around the track than Bill.
- (A) I only
 - (B) II only
 - (C) I and II only
 - (D) I and III only

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14. The figure above shows part of the graph of function f . If $f(x + 6) = f(x)$ for all values of x , what is the value of $f(23)$?

- (A) 0
- (B) 2
- (C) 3
- (D) 4

15. Which function could represent the graph above?

- (A) $f(x) = (x - 6)(x^2 - 4x + 3)$
- (B) $f(x) = (x - 3)(x^2 + x - 2)$
- (C) $f(x) = (x - 1)(x^2 - 5x - 6)$
- (D) $f(x) = (x + 2)(x^2 - 4x - 12)$

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16. On a test that has a normal distribution of scores, a score of 59 falls two standard deviations below the mean, and a score of 74 is one standard deviation above the mean. If x is an integer score that lies between 2.5 and 3.0 standard deviations above the mean, what is a possible value of x ?

Hours Worked in a Week	Total Payment
8	\$108.00
23	\$310.50
17	\$229.50

17. Andrew keeps track of his paychecks over the past several weeks, recording the number of hours he worked and his total payments as indicated in the table above. He wants to model the relationship between h hours worked and total payments p , in dollars, using an equation of the form $p = kh$ where k is a constant. Based on the data in the table, what value of k should he use?

18. If $\frac{-3}{x} + 4 \leq -11$ and $x > 0$, what is the *greatest* possible value for x ?

19. The equation of a circle in the xy -plane is $x^2 + 4x + y^2 - 10y = 20$. If the line $x = k$ intersects the circle in exactly one point, what is a possible value of k ?

x	1	2	3	4	5
$f(x)$	3	4	5	6	7

x	3	4	5	6	8
$g(x)$	4	6	8	10	7

20. The tables above give the values of functions f and g for several values of x . If $g(f(b)) = 8$, what is the value of b ?

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MATHEMATICS TEST—CALCULATOR

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

PRACTICE TEST 1

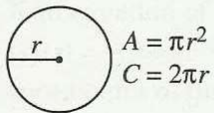
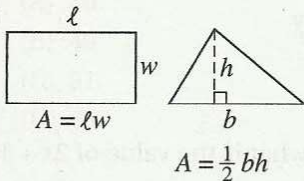
Directions: For questions 1-30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31-38, solve the problem and fill in the answer on the answer sheet grid.

Notes:

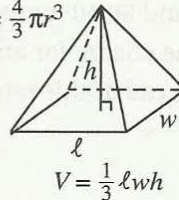
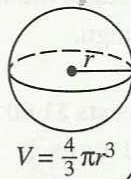
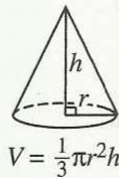
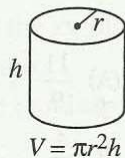
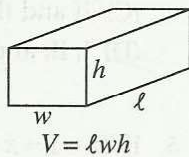
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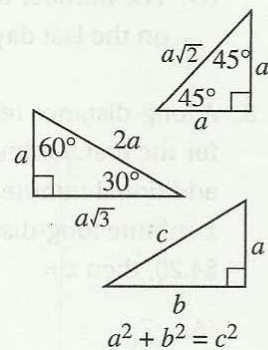
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360° .

The arc of a circle contains 2π radians.

The sum of the measures of the angles in a triangle is 180° .

GO ON TO THE NEXT PAGE

1. If $(2b - 7)(2b + 7) = 1$, what is the value of $2b^2$?

(A) 15
 (B) 25
 (C) 32
 (D) 50

2. The number of donation pledges, p , made to a charity d days after the charity began a campaign for donations can be approximated by the equation $p = 117 + 32d$. What is the best interpretation of the number 32 in this equation?

(A) The number of donation pledges received before the campaign for donations started.
 (B) The total number of donation pledges received during the campaign.
 (C) The number of donation pledges received each day of the campaign.
 (D) The number of donation pledges made on the last day of the campaign.

3. A long-distance telephone call costs \$1.80 for the first 3 minutes and \$0.40 for each additional minute. If the charge for an x -minute long-distance call at this rate was \$4.20, then $x =$

(A) 7
 (B) 8
 (C) 9
 (D) 10

Gender	Type of College				Total
	4-Year Same State	2-Year Same State	4-Year Out-of-State	None	
Male	64	26	22	7	119
Female	41	19	15	6	81
Total	105	45	37	13	200

4. Based on the data in the table above, which of the following statements must be true?

I. For every 3 men who applied to a same state college, 2 women applied to a same state college.
 II. If a female student is selected at random, the probability that she did not apply to a 2-year college is greater than 75%.
 III. Of the students who applied to a same state college, 40% were females.

(A) I and II only
 (B) I and III only
 (C) II and III only
 (D) I, II, and III

5. If $3x - 1 = x - \frac{7}{9}$, what is the value of $2x + 1$?

(A) $\frac{11}{9}$
 (B) $\frac{4}{3}$
 (C) $\frac{25}{9}$
 (D) $\frac{10}{3}$

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6. The price of gas increased by 12% per gallon sometime during the first fiscal quarter and then decreased by 25% per gallon by the end of the second fiscal quarter. The final price of gas per gallon at the end of the second quarter decreased by what percent compared to the starting price at the beginning of the first fiscal quarter?

- (A) 13%
- (B) 16%
- (C) 18.5%
- (D) 20%

7. A population, $T(x)$, of wild turkeys, in a certain rural area is represented by the function $T(x) = 17(1.15)^{2x}$, where x is the number of years since 2010. According to this model, how many more turkeys are in the population for the year 2015 than were available for 2010?

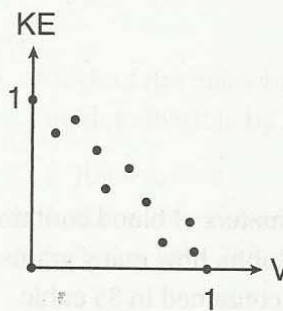
- (A) 46
- (B) 49
- (C) 51
- (D) 68

8. If an equation of a parabola in the xy -plane is $f(x) = -(x + 2)^2 - 1$, what are the coordinates of the vertex of the parabola defined by $g(x) = f(x - 2)$?

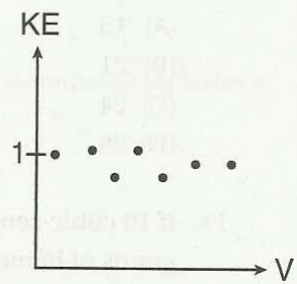
- (A) (0, -1)
- (B) (4, -1)
- (C) (-2, -3)
- (D) (-2, 1)

9. A city planner estimates that due to lower birth rates and changing demographics, enrollment in city's public schools will decrease at the rate of 16% per year for the next 5 years. If the city planner uses the equation $P = P_0(r)^n$ to estimate the school enrollment, P , after n years, what value should be used for the value of r ?

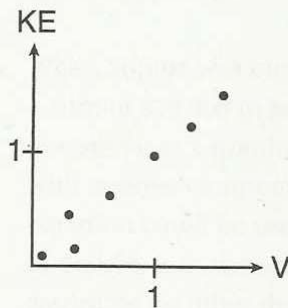
- (A) 1.16
- (B) 0.84
- (C) 0.80
- (D) 0.16



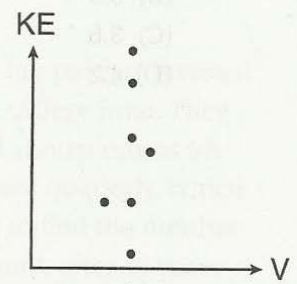
(1)



(3)



(2)



(4)

10. In the physics lab, a student determined the kinetic energy, KE , of an object at various velocities, V , and found a strong positive association between KE and V . Which of the above scatterplots show this relationship?

- (A) Graph (1)
- (B) Graph (2)
- (C) Graph (3)
- (D) Graph (4)

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11. The average (arithmetic mean) of a , b , c , and d is 3 times the median. If $0 < a < b < c < d$, what is a in terms of b , c , and d ?

(A) $5(b + c) - d$
 (B) $3(b + c) + d$
 (C) $5(b + c) + d$
 (D) $3(b + c) - d$

12. A person spent a total of \$720 for dress shirts and sport shirts, each priced at \$35 and \$20, respectively. If the person purchased two \$35 dress shirts for each \$20 sport shirt, what is the total number of shirts purchased?

(A) 16
 (B) 21
 (C) 24
 (D) 28

13. If 10 cubic centimeters of blood contains 1.2 grams of hemoglobin, how many grams of hemoglobin are contained in 35 cubic centimeters of the same blood?

(A) 2.7
 (B) 3.0
 (C) 3.6
 (D) 4.2

Players' Salaries (in millions of dollars)					
0.5	0.5	0.6	0.7	0.75	0.8
1.0	1.0	1.1	1.25	1.3	1.4
1.6	1.8	2.5	3.7	3.8	4.0
4.2	4.6	5.1	6.0	6.3	7.2
Total = 61.7 Million					

14. The table above shows the annual salaries for the 24 members of a professional sports team in terms of millions of dollars. If the team signs an additional player to a contract worth 7.3 million dollars per year, which statement about the median and mean is true?

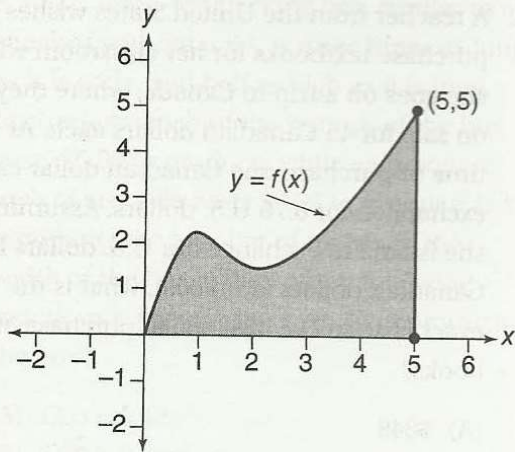
(A) The median and mean will increase by the same amount.
 (B) The median will increase by a greater amount.
 (C) The mean will increase by a greater amount.
 (D) Neither will change.

$$m = \frac{M}{\sqrt{1 - \frac{v^2}{c^2}}}$$

15. The equation above describes, according to Einstein's theory of relativity, how the mass of an object increases with velocity where m is the mass of a moving object, M is the mass the object when it is not moving, v is the velocity of the object relative to a stationary observer, and c is the speed of light. Which of the following expresses v in terms of m , M , and c ?

(A) $c\sqrt{1 - \left(\frac{M}{m}\right)^2}$
 (B) $c\sqrt{1 + \left(\frac{M}{m}\right)^2}$
 (C) $\sqrt{c^2 + \left(\frac{M}{m}\right)^2}$
 (D) $\sqrt{\left(c + \frac{M}{m}\right)^2 - 1}$

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16. Function f is defined for $0 \leq x \leq 5$, as shown in the accompanying figure. If (r, s) is a point inside the shaded region bounded by the x -axis, the line $x = 5$, and $y = f(x)$, which statement must be true?

- I. $r + s \leq 5$
- II. $s \leq f(r)$
- III. $r \neq s$

- (A) I only
- (B) II only
- (C) III only
- (D) I and III only

17. Natalie is planning a school celebration and wants to have live music and food for everyone who attends. She has found a band that will charge her \$750 and a caterer who will provide snacks and drinks for \$2.25 per person. If her goal is to keep the average cost per person between \$2.75 and \$3.25, how many people, p , must attend?

- (A) $225 < p < 325$
- (B) $325 < p < 750$
- (C) $500 < p < 1,000$
- (D) $750 < p < 1,500$

18. If $p(x)$ is a polynomial function with $p(3) = 0$, which statement must be true?

- (A) $p(x)$ is divisible by 3.
- (B) $x - 3$ is a factor of $p(x)$.
- (C) $p(x)$ is divisible by $x + 3$.
- (D) The highest power of x in $p(x)$ is 3.

19. A group of p people plan to contribute equally to the purchase of a gift that costs d dollars. If n of the p people decide not to contribute, by what amount in dollars does the contribution needed from each of the remaining people increase?

- (A) $\frac{d}{p-n}$
- (B) $\frac{pd}{p-n}$
- (C) $\frac{pd}{n(p-n)}$
- (D) $\frac{nd}{p(p-n)}$

20. Which of the following statements includes a function divisible by $2x + 1$?

- I. $f(x) = 8x^2 - 2$
- II. $g(x) = 2x^2 - 9x + 4$
- III. $h(x) = 4x^3 + 2x^2 - 6x - 3$

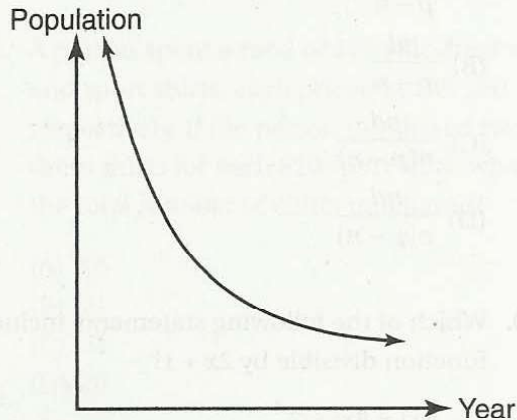
- (A) I only
- (B) I and II only
- (C) I and III only
- (D) I, II, and III

21. When Sophie was born her parents invested a sum of \$20,000 in her college fund. They invested it at a nominal annual rate of 5% with interest compounded quarterly. Which equation could be used to find the number of dollars, y , in the account, after 18 years assuming no other deposits or withdrawals are made?

- (A) $y = 20,000(1.05)^{18}$
- (B) $y = 20,000(0.21)^{18 \times 4}$
- (C) $y = 20,000(1.0125)^{\frac{18}{4}}$
- (D) $y = 20,000(1.0125)^{18 \times 4}$

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22. If function g is defined by $g(x) = x - 1$ and $2g(c) = 10$, what is the value of $g(3c)$?
- (A) 6
(B) 9
(C) 15
(D) 17



23. The graph above shows how the size of a country's population has changed over time. Which of the following are the most likely underlying reasons for the type of graph shown?
- (A) A moderate increase in annual birthrates and a liberal immigration policy.
(B) A large increase in annual birthrates and increased life expectancy rates.
(C) A liberal immigration policy and a thriving economy with increased job opportunities.
(D) The spread of a highly contagious fatal disease and a history of political strife and unrest.

24. A teacher from the United States wishes to purchase textbooks for her classroom when she goes on a trip to Canada, where they are on sale for 45 Canadian dollars each. At the time of purchase one Canadian dollar can be exchanged for 0.76 U.S. dollars. Assuming she is able to exchange her U.S. dollars for Canadian dollars at no cost, what is the exact cost, in U.S. dollars, to purchase 30 books?

- (A) \$849
(B) \$1026
(C) \$1350
(D) \$1776

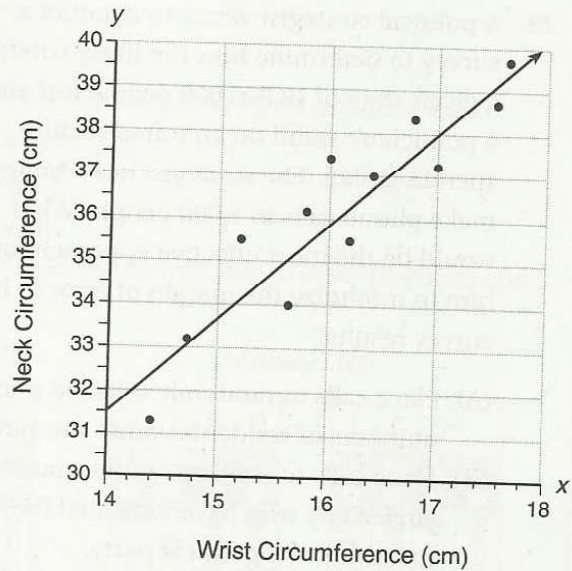
Age (years)	Average Pupil Diameter (mm)
20	4.7
40	3.9
60	3.1
80	2.3

25. The table above shows the average diameter, in millimeters, of a pupil in a person's eye as she or he grows older from age 20 to age 80. Which equation expresses the relationship between pupil diameter, p , and age, a ?
- (A) $p = -0.04a + 5.5$
(B) $p = 0.04a + 3.9$
(C) $p = -0.04a + 34.3$
(D) $p = 0.235a$

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26. A small, open-top packing box, similar to a shoebox without a lid, is three times as long as it is wide, and half as high as it is long. Each square inch of the bottom of the box costs \$0.08 to produce, while each square inch of any side costs \$0.03 to produce. If x represents the number of inches in the width of the box, which of the following functions represent the cost, C , of producing the box?

- (A) $C(x) = 0.42x^2$
- (B) $C(x) = 0.60x^2$
- (C) $C(x) = 0.72x^2$
- (D) $C(x) = 0.96x^2$



27. The scatterplot above summarizes the wrist and neck circumference measurements, in centimeters, for 12 people. The line of best fit is drawn. What proportion of the 12 measurements satisfy the inequality $|o - p| \leq d$ where o is the observed measurement, p is corresponding measurement predicted by the line of best fit, and d is 0.5 cm?

- (A) $\frac{1}{6}$
- (B) $\frac{1}{4}$
- (C) $\frac{1}{3}$
- (D) $\frac{1}{2}$

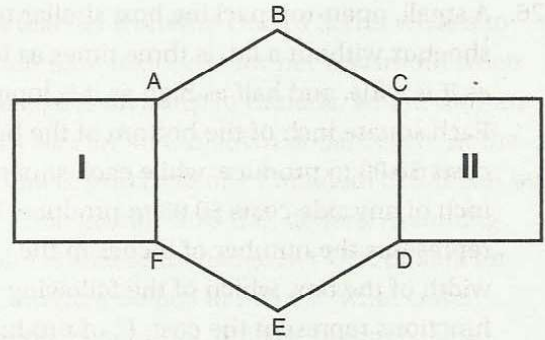
28. An arch is built so that it has the shape of a parabola with the equation $y = -3x^2 + 24x$ where y represents the height of the arch in meters. How many times greater is the maximum height of the arch than the width of the arch at its base?

- (A) 4
- (B) 6
- (C) 8
- (D) 12

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29. A political strategist wants to conduct a survey to determine how the likely voters in a given state of 10,000,000 people feel about a politician's stand on an infrastructure spending plan. The strategist has a budget to make phone calls to 1,000 people. What would be the most effective approach for him to minimize the margin of error in his survey results?

- (A) Place calls to randomly selected phone numbers of residents within the state.
- (B) Place calls to residents of the state's largest city who have indicated they are members of a political party.
- (C) Place calls to rural residents of the state who have demonstrated political activism.
- (D) Place calls to places of business so that people can more likely be reached during the work day.



30. A metal belt buckle is being designed so that it has the shape of a regular hexagon in the center and squares at opposite ends as shown in the figure above where $ABCDEF$ is a regular hexagon and figures I and II are squares. The hexagon will be gold plated and the two squares silver plated. The length of a side of each square is 6 centimeters. Which of the following is closest to the percent of the total surface area of the buckle that will be silver plated?

- (A) 41
- (B) 44
- (C) 47
- (D) 49

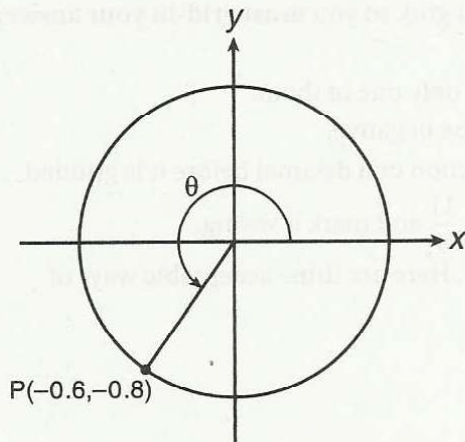
3 teaspoons = 1 tablespoon

16 tablespoons = 1 cup

1 cup = 8 ounces

29.6 milliliters = 1 ounce

31. Using the conversion relationships above, what is the maximum number of 2-teaspoon doses of cough medicine that can be dispensed from a bottle that contains 225 milliliters of cough medicine?
32. NASA's *New Horizons* interplanetary probe has been making its way to Pluto since January 2006. In July 2015, it reached Pluto and sent a radio transmission signal at a speed of 1.86×10^5 miles per second. If the signal traveled a distance back to Earth of approximately 3.06×10^9 miles, how many minutes did it take for the signal to reach Earth, *correct to the nearest 5 minutes*?
34. If $a + 2b = 13$ and $8a + b = 20$, what is value of $3a + b$?
35. An opinion poll survey was conducted in which 120 sports fans and 75 non-sports fans participated. If the sample size was increased by 65 non-sports fans, how many sports fans should be added so that $\frac{3}{5}$ of those polled are sports fans?
36. The Eye Surgery Institute just purchased a new laser machine for \$500,000 to use during eye surgery. The Institute must pay the inventor \$550 each time the machine is used. If the Institute charges \$2,000 for each laser surgery, what is the *minimum* number of surgeries that must be performed in order for the Institute to make a profit?



33. If $P(-0.6, -0.8)$ is a point on the unit circle in the figure above, what is the *exact* value of $\tan \theta + \sin \theta$?

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Questions 37 and 38 refer to the following information

The U.S. Federal Government tracks the Consumer Price Index (CPI)—a comprehensive standard used to estimate the average price change for the typical goods and services purchased by consumers. This measure gives economists a useful way to estimate the rates of inflation or deflation, which reflects the respective general increase or decrease of prices of goods and service in the economy. The accompanying tables summarizes the changes in the CPI for the years 2005 through 2014, which can be assumed to be the corresponding percent rates of inflation.

Yearly Percent Change in Urban Consumer Price Index in the United States

Year	Annual	First Half of Year	Second Half of Year
2005	3.4	3.0	3.8
2006	3.2	3.8	2.6
2007	2.8	2.5	3.1
2008	3.8	4.2	3.4
2009	-0.4	-0.6	-0.1
2010	1.6	2.1	1.2
2011	3.2	2.8	3.5
2012	2.1	2.3	1.8
2013	1.5	1.5	1.4
2014	1.6	1.7	1.5

Source: United States Bureau of Labor and Statistics

37. An economist purchases a kitchen appliance at the beginning of 2014 for \$3,000. The salesperson advises him that the only changes in price for the appliance since the beginning of 2012 have been due to inflation. Assuming that is the case, what would have been the purchase price for the appliance at the beginning of 2012 *correct to the nearest dollar*?
38. At the beginning of 2015, a retired person is shopping for a retirement annuity, which is an investment policy that will give him fixed monthly payments for the rest of his life. He would like the amount of his annuity payments to more than keep up with the rate of inflation. He decides that he will choose a policy that issues payments that increase annually at a rate that is at least 1.5% greater than the *average* yearly compounded rate of inflation calculated from the period that extends from the second half of 2005 through the first half of 2008. What should be the minimum annual rate of increase in his monthly annuity payments, *correct to the nearest tenth*?

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Answer Key For Practice Test 1

Math (No Calculator)

- 1. **C**
- 2. **C**
- 3. **C**
- 4. **D**

- 5. **B**
- 6. **A**
- 7. **D**
- 8. **C**

- 9. **B**
- 10. **D**
- 11. **B**
- 12. **D**

- 13. **D**
- 14. **D**
- 15. **B**

16.

		8	3
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6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17.

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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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18.

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19.

			5
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20.

			3
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5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer Key For Practice Test 1

Math (Calculator)

- | | | | |
|-------------|--------------|--------------|--------------|
| 1. B | 9. B | 17. D | 25. A |
| 2. C | 10. B | 18. B | 26. B |
| 3. C | 11. A | 19. D | 27. C |
| 4. D | 12. C | 20. C | 28. B |
| 5. A | 13. D | 21. D | 29. A |
| 6. B | 14. C | 22. D | 30. B |
| 7. C | 15. A | 23. D | |
| 8. A | 16. B | 24. B | |

31.

		2	2
○	○	○	○
1	1	1	1
2	2	●	●
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

32.

	2	7	5
○	○	○	○
1	1	1	1
2	●	2	2
3	3	3	3
4	4	4	4
5	5	5	●
6	6	6	6
7	7	●	7
8	8	8	8
9	9	9	9

33.

	8	/	1	5
○	○	○	○	○
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	●
6	6	6	6	6
7	7	7	7	7
8	●	8	8	8
9	9	9	9	9

34.

		1	1
○	○	○	○
1	1	1	1
2	2	2	●
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

35.

		9	0
○	○	○	○
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	●	8
9	9	9	9

36.

	3	4	5
○	○	○	○
1	1	1	1
2	2	2	2
3	●	3	3
4	4	●	4
5	5	5	●
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

37.

	2	8	9	5
○	○	○	○	○
1	1	1	1	1
2	●	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	●
6	6	6	6	6
7	7	7	7	7
8	●	8	8	8
9	9	●	9	9

38.

			5
○	○	○	○
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	●
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

ANSWER EXPLANATIONS FOR PRACTICE TEST 1

No-Calculator Section

1. **(C)** If $x^{-2} = 64$, then $\frac{1}{x^2} = 64$ so $x = \sqrt{\frac{1}{64}} = \frac{1}{8}$. Then $x^{\frac{1}{3}} = \left(\frac{1}{8}\right)^{\frac{1}{3}} = \frac{1}{\sqrt[3]{8}} = \frac{1}{2}$.
2. **(C)** Given $C(n) = 110n + 900$, \$900 is a fixed cost that does not depend on n , the number of commercials aired, and \$110 is the rate at which the cost changes per each additional commercial aired.
3. **(C)** It is given that the slope of the graph of the linear function is -2 and $f(3) = 4$, which means that the point $(3, 4)$ is on the line. The equation of the linear function has the form $y = mx + b$. To find the value of b , let $m = -2$, $x = 3$, and $y = 4$:

$$4 = -2(3) + b$$

$$4 = -6 + b$$

$$10 = b$$

4. **(D)** If $x - 3$ is 1 less than $y + 3$, then $x - 3 = (y + 3) - 1$ so $x = y + 5$. Adding 2 to each side of $x = y + 5$ gives $x + 2 = y + 7$. Hence, $x + 2$ exceeds y by 7.
5. **(B)** The weight that is midway between the smallest and greatest box weights is $\frac{2.85 + 3.45}{2} = \frac{6.3}{2} = 3.15$ pounds. The difference between the smallest or greatest box weights and 3.15 pounds is 0.3 pounds since $3.15 - 2.85 = 3.45 - 3.15 = 0.3$. If w represents the weight of any one of the 5 boxes, then the positive difference between w and 3.15 pounds must be less than or equal to 0.3 pounds, which can be expressed using the absolute value inequality $|w - 3.15| \leq 0.3$.

6. **(A)** Since $\text{rate} \times \text{time} = \text{distance}$, $\text{time} = \frac{\text{distance}}{\text{rate}}$. Time spent jogging, in hours, is $\frac{x}{4}$.

Time spent bicycling, in hours, is $\frac{y}{8}$ and 45 minutes is equivalent to $\frac{45}{60} = \frac{3}{4}$ hour. If

Mikala works out for *at least* 45 minutes, then $\frac{x}{4} + \frac{y}{8} \geq \frac{3}{4}$.

7. **(D)** If $7^k = 100$, then

$$(7^k)^{\frac{1}{2}} = (100)^{\frac{1}{2}}$$

$$7^{\frac{k}{2}} = \sqrt{100} = 10$$

Hence, $7^{\frac{k}{2}+1} = 7^1 \cdot 7^{\frac{k}{2}} = 7(10) = 70$.

8. (C) Compare the given equations in slope-intercept form:

- If $3y + 6 = 2x$, then $y = \frac{2}{3}x - 2$.
- If $2y - 3x = 6$, then $y = \frac{3}{2}x + 3$.
- Since the lines have slopes that are different, the graphs of the lines intersect so there is one solution. The slopes are not negative reciprocals, so the lines do not intersect at right angles in the xy -plane.

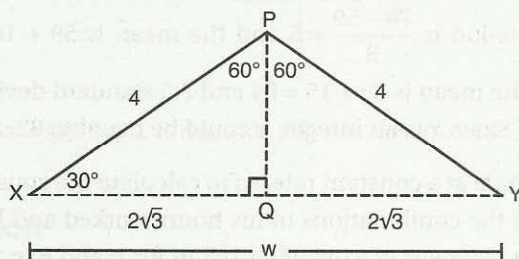
9. (B) If $y = (2x - 6)(x + 1) = 2x^2 - 4x - 6$. The y -intercept of the parabola is -6 since when $x = 0$, $y = -6$. Hence, Statement III is true. Write the parabola equation in vertex form by completing the square:

$$\begin{aligned} y &= 2x^2 - 4x - 6 \\ &= 2(x^2 - 2x + 1) - 6 - 2 \\ &= 2(x - 1)^2 - 8 \end{aligned}$$

The vertex of the parabola is $(1, -8)$ so the $x = 1$ is a vertical line of symmetry and -8 is the minimum value of y , which means Statement I is false and Statement II is true. Hence, only Statements II and III are true.

10. (D) In general, a probability level of $p\%$ associated with a confidence interval does *not* give the probability that the sample statistic is in the interval of a particular sample. Instead, it states that if a large number of samples are repeatedly drawn from a population, then the sample statistic will be in the stated interval of values $p\%$ of the time. In this problem, the range of the interval is $60\% \pm 5\%$. Hence, if the survey were to be repeated 100 times, 95% of the time the number of people who would *not* support the issuing of the bond would fall between 55% and 65% of those surveyed.

11. (B) The central angle formed measures $\frac{360}{3} = 120$. Draw perpendicular \overline{PQ} from the center of the circle to \overline{XY} , which bisects the angle and \overline{XY} :



In a right triangle, the length of the side opposite the 60° angle is one-half of the hypotenuse. Hence, $XQ = 2\sqrt{3}$ so $w = 2\sqrt{3} + 2\sqrt{3} = 4\sqrt{3}$.

$$12. \text{ (D) } Z_T = \frac{(1+2i)(1-2i)}{(1+2i)+(1-2i)} = \frac{1-4i^2}{2} = \frac{1-4(-1)}{2} = \frac{5}{2}.$$

13. **(D)** Determine whether each Roman numeral choice is true or false:

- I. From the graph, Bill walks 1 mile in 30 minutes. Since he is walking at a constant rate, he walks 2 miles in 60 minutes. Hence, Bill's average rate of walking was 2 miles per hour. This choice is correct.
- II. At 9:10 A.M., Allan jogged 1 mile. Since Bill was walking at a constant rate of 2 miles per hour, he walked

$$2 \text{ miles} \times \frac{1}{6} \text{ hr} (= 10 \text{ min}) = \frac{1}{3} \text{ mile.}$$

Hence, at 9:10 A.M. Allan had jogged $1 - \frac{1}{3} = \frac{2}{3}$ mile more than Bill had walked. This choice is not correct.

- III. At 9:30 A.M., Allan had jogged 3 miles and Bill had walked 1 mile. Hence, Allan jogged 2 miles more than Bill had walked. Four laps around a $\frac{1}{4}$ -mile track equals 1 mile. Hence, Allan completed 8 more laps around the track than Bill. This choice is correct.

Since Roman numeral choices I and III are correct, the answer is choice (D).

14. **(D)** Since $f(x+6) = f(x)$, $f(23) = f(17) = f(11) = f(5)$. Reading from the graph, $f(5) = 4$.

15. **(B)** Since the x -intercepts of the graph of a function correspond to its x -intercepts,

$$\begin{aligned} f(x) &= (x - (-2))(x - 1)(x - 3) \\ &= (x + 2)(x - 1)(x - 3) \\ &= (x - 3)(x + 2)(x - 1) \\ &= (x - 3)(x^2 + x - 2) \end{aligned}$$

16. **(83)** The difference between 74 and 59 represents a width of 3 standard deviations so 1 standard deviation is $\frac{74-59}{3} = 5$ and the mean is $59 + 10 = 69$. Three standard deviations above the mean is $69 + 15 = 84$ and 2.5 standard deviations above the mean is $69 + 12.5 = 81.5$. Since x is an integer, x could be equal to 82, 83, or 84.

17. **(13.5)** Andrew is paid at a constant rate, so to calculate the constant of proportionality, simply take one of the combinations of his hours worked and his total payment. Let's take 8 hours and a payment of \$108. Plug 108 in for p and 8 in for h : $108 = k \times 8$. Then divide both sides by 8 to solve for k , giving a value of 13.5 for k .

18. **(1/5)** Simplify the inequality and isolate x . If $\frac{-3}{x} + 4 \leq -11$, then

$$\frac{-3}{x} \leq -15$$

$$\frac{1}{x} \geq 5$$

$$\frac{1}{5} \geq x \text{ so } x \leq \frac{1}{5}$$

The greatest value of x is $1/5$.

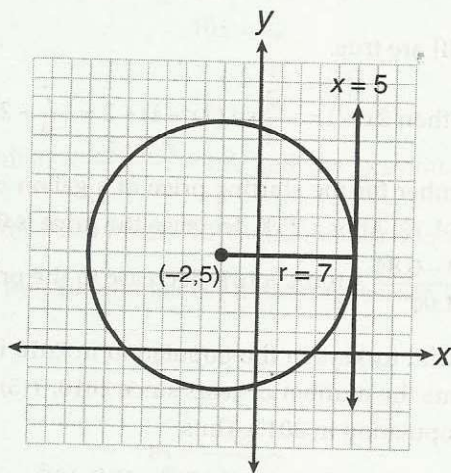
19. **(5)** Rewrite the equation of the circle in center-radius form by completing the square for both x and y :

$$x^2 + 4x + y^2 - 10y = 20$$

$$(x^2 + 4x + 4) + (y^2 - 10y + 25) = 20 + 4 + 25$$

$$(x + 2)^2 + (y - 5)^2 = 49$$

The center of the circle is $(-2, 5)$ with radius 7. The line $x = k$ is a vertical line. Since it is given that it intersects the circle in one point, it intersects the circle at a horizontal distance of 7 units from $x = -2$ so $k = -2 + 7 = 5$ or $-2 - 7 = -9$



20. **(3)** It is given that $g(f(b)) = 8$. Since $g(5) = 8$, $f(b) = 5$ so $x = 3$.

Calculator Section

- (B)** If $(2b - 7)(2b + 7) = 1$, then $4b^2 - 49 = 1$ so $4b^2 = 50$ and $2b^2 = \frac{50}{2} = 25$.
- (C)** In the linear function $p = 117 + 32d$, 32 is the coefficient of d , the number of days, so it represents the rate of change of p (the number of pledges) received per day.

3. **(C)** If a call lasts x minutes and x is greater than 3, then the charge for the first 3 minutes is \$1.80 and the charge for the next $x - 3$ minutes is $0.40(x - 3)$. Since the total charge was \$4.20,

$$0.40(x - 3) + 1.80 = 4.20$$

$$40(x - 3) + 180 = 420$$

$$40x - 120 + 180 = 420$$

$$40x = 360$$

$$x = \frac{360}{40} = 9$$

4. **(D)** Consider each Roman numeral statement in turn.
- I. Number of men who applied to a same state college to the number of women who did the same is $\frac{64 + 26}{41 + 19} = \frac{90}{60} = \frac{3}{2}$. Hence, Statement I is true. ✓
 - II. The probability that a female student selected at random did not apply to a 2 year college is $\frac{41 + 15 + 6}{81} = \frac{62}{81} \approx .765 > 75\%$. Thus, Statement II is true. ✓
 - III. Of the students who applied to a same state college, the percent of females is $\frac{41 + 19}{105 + 45} = \frac{60}{150} = \frac{2}{5} = 40\%$. Hence, Statement III is true. ✓

Statements I, II, and III are true.

5. **(A)** If $3x - 1 = x - \frac{7}{9}$, then $2x - 1 = -\frac{7}{9}$ so $(2x - 1) + 2 = -\frac{7}{9} + 2$ and $2x + 1 = \frac{11}{9}$.
6. **(B)** Pick an easy number for the starting price of a gallon of gas, say \$1. After a 12% increase the price is \$1.12. After a 25% decrease the price is $0.75 \times \$1.12 = \0.84 , which corresponds to a $\frac{1.00 - 0.84}{1.00} \times 100\% = 16\%$ decrease in the price of a gallon of gas.
7. **(C)** The number of wild turkeys in the population in 2010 is calculated by evaluating $T(0)$. Since x represents the number of years since 2010, $T(5)$ represents the number of wild turkeys in the population in 2015. Thus,

$$\begin{aligned} T(5) - T(0) &= 17(1.15)^{10} - 17(1.15)^0 \\ &= 17(4.04 - 1) \\ &= 17(3.04) \\ &= 51.68 \end{aligned}$$

Since the answer must be a whole number, round down to 51.

8. **(A)** If $g(x) = f(x - 2)$, the function g is the function that results from shifting function f 2 units to the right in the horizontal direction. The vertex of the parabola $f(x) = -(x + 2)^2 - 1$ is $(-2, -1)$, which shifted 2 units to the right is mapped onto $(0, -1)$.
9. **(B)** Since $1 - 16\% = 1 - 0.16 = 0.84$, the city planner should use .84 for r .
10. **(B)** A strong positive association in a scatterplot is indicated by a cluster of data points that is rising from left to right which, of the four graphs, is best illustrated by graph (2).

11. **(A)** The median of an ordered set of 4 numbers is the average of the two middle values.

Hence,

$$\frac{a+b+c+d}{4} = 3 \left[\frac{(b+c)}{2} \right]$$

$$a+b+c+d = 6b+6c$$

$$a = 5b+5c-d$$

$$= 5(b+c)-d$$

12. **(C)** If x represents the number of \$20 sport shirts purchased, then $2x$ is the number of \$35 dress shirts purchased. Since a total of \$720 was spent on the shirts, $20(x) + 35(2x) = 720$ or $20x + 70x = 720$, so $90x = 720$. Hence,

$$x = \frac{720}{90} = 8 \quad \text{and} \quad 2x = 2(8) = 16$$

The total number of shirts purchased is $x + 2x$ or $8 + 16 = 24$.

13. **(D)** If there are 1.2 grams of hemoglobin in 10 cubic centimeters of blood and x represents the number of grams of hemoglobin contained in 35 cubic centimeters of the same blood, then

$$\frac{\text{Blood}}{\text{Hemoglobin}} = \frac{10}{1.2} = \frac{35}{x}$$

$$10x = 42$$

$$x = \frac{42}{10} = 4.2$$

14. **(C)** The previous median = $\frac{1.4+1.6}{2} = 1.5$, and the previous mean = $\frac{61.7}{24} \approx 2.57$. The new median is the 13th score, which is 1.6, and the new mean = $\frac{61.7+7.3}{25} = 2.76$.

The median increases by 0.10, whereas the mean increases by 0.19 so the mean increases by a greater amount.

15. **(A)**

$$m = \frac{M}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$\left(\sqrt{1-\frac{v^2}{c^2}} \right)^2 = \left(\frac{M}{m} \right)^2$$

$$1 - \frac{v^2}{c^2} = \left(\frac{M}{m} \right)^2$$

$$\frac{v^2}{c^2} = 1 - \left(\frac{M}{m} \right)^2$$

$$v^2 = c^2 \left(1 - \left(\frac{M}{m} \right)^2 \right)$$

$$\sqrt{v^2} = \sqrt{c^2 \left(1 - \left(\frac{M}{m} \right)^2 \right)}$$

$$v = c \sqrt{1 - \left(\frac{M}{m} \right)^2}$$

16. **(B)** Consider each Roman numeral choice in turn:
- I. Roman numeral choice I is false, since the point $(4, 2)$ lies inside the shaded region and $4 + 2 > 5$. **X**
 - II. For any given point (r, s) inside the shaded region, $f(r)$ represents the y -value of the point on the graph directly above it, so $s \leq f(r)$. For example, if $f(r, s) = (3, 1)$, then $1 < f(3)$ since $f(3)$, according to the graph, has a value between 1 and 2. Roman numeral choice II must be true. **✓**
 - III. Because points such as $(1, 1)$ are contained in the shaded region, it is not always the case that $r \neq s$. Roman numeral choice III is false. **X**

Since only Roman numeral choice II must be true, the correct answer is choice **(B)**.

17. **(D)** The cost for p people attending is $\frac{750 + 2.25p}{p} = \frac{750}{p} + 2.25$, which must be between \$2.75 and \$3.25 per person so

$$2.75 < \frac{750}{p} + 2.25 < 3.25$$

$$0.50 < \frac{750}{p} < 1.00$$

$$0.50p < 750 \text{ and } 750 < 1.00p$$

- If $0.50p < 750$, then $p < \frac{750}{0.50}$ so $p < 1,500$.
 - If $750 < 1.00p$, then $p > 750$.
 - Hence, $750 < p < 1,500$.
18. **(B)** If $p(x)$ is a polynomial function and $p(r) = 0$, then the remainder when $p(x)$ is divided by $x - r$ is 0 so $p(x)$ is divisible by $x - r$ or, equivalently, $x - r$ is a factor of $p(x)$. Since it is given that $p(3) = 0$, $x - 3$ is a factor of $p(x)$.
19. **(D)** If a group of p people plan to contribute equally to the purchase of a gift that costs

d dollars, then each person must contribute $\frac{d}{p}$ dollars. If n of the p people decide not to contribute, then each of the $p - n$ people who are left must contribute $\frac{d}{p - n}$ dollars.

The difference between the two contribution rates represents the amount of increase for each person who contributes:

$$\begin{aligned} \frac{d}{p - n} - \frac{d}{p} &= \frac{d}{p - n} \left(\frac{p}{p} \right) - \frac{d}{p} \left(\frac{p - n}{p - n} \right) \\ &= \frac{dp - d(p - n)}{p(p - n)} \\ &= \frac{dp - dp + nd}{p(p - n)} \\ &= \frac{nd}{p(p - n)} \end{aligned}$$

20. **(C)** To determine if a function is divisible by $2x + 1$, check to see if it is a factor. Consider each statement in turn.

■ I. $f(x) = \frac{8x^2 - 2}{2x + 1} = \frac{2(4x^2 - 1)}{2x + 1} = \frac{2(2x - 1)\cancel{(2x + 1)}}{2x + 1} = 2(2x - 1)$. ✓

■ II. $g(x) = \frac{2x^2 - 9x + 4}{2x + 1} = \frac{(2x - 1)(x - 4)}{2x + 1}$ ✗

■ III. $h(x) = \frac{4x^3 + 2x^2 - 6x - 3}{2x + 1} = \frac{(4x^3 + 2x^2) - (6x + 3)}{2x + 1}$
 $= \frac{\cancel{(2x + 1)}(2x^2 - 3)}{2x + 1}$
 $= 2x^2 - 3$ ✓

Only Statements I and III are true.

21. **(D)** The function $y = A(1 + r)^n$ describes exponential growth of an initial amount, A , with a compound rate of growth of $r\%$ where n represents the number of compounding periods. In this problem, $A = 20,000$, $r = \frac{5\%}{4} = 0.0125$, and $n = 18 \times 4$ so $y = 20,000(1.0125)^{18 \times 4}$.

22. **(D)** If $g(x) = x - 1$ and $2g(c) = 10$, then $g(c) = \frac{10}{2} = 5$.

- $g(c) = c - 1 = 5$ so $c = 6$.
- $g(3c) = 3c - 1 = 3(6) - 1 = 17$.

23. **(D)** The graph describes exponential decay, which means that the population will *decrease* at an exponential rate. An increase in birthrate would *increase* the population, making choices A and B incorrect. A liberal immigration policy and thriving economy would contribute to population growth so choice C is not correct. A highly contagious illness would spread rapidly and would be most likely to cause a drastic, geometric decline in population. Political strife and unrest would tend to make more people leave the country further contributing to an ongoing decline in the size of the population.
24. **(B)** First, calculate the total number of Canadian dollars she will need to make her purchase by multiplying the number of books by the price per book in Canadian dollars: $30 \times 45 = 1,350$. Then, convert this amount to U.S. dollars by multiplying by the U.S. to Canadian dollar exchange rate: $1,350 \times .76 = 1,026$.

25. **(A)** Pick any two years and figure out the rate of change (slope). Using the first two rows of the table:

$$\frac{3.9 - 4.7}{40 - 20} = -\frac{0.8}{20} = -0.04.$$

You can eliminate choices (B) and (D). The desired equation has the form $y = -0.04a + b$. To find b , substitute 20 for a and 4.7 for p :

$$4.7 = -0.04(20) + b$$

$$4.7 = -0.8 + b$$

$$b = 5.5$$

The equation $y = -0.04a + 5.5$ expresses the relationship between p and a .

26. **(B)** If x represents the number of inches in the width of the box, then $3x$ is the length and $\frac{1}{2}(3x) = 1.5x$ is the height. Hence,

- The area of the base is $(x)(3x) = 3x^2$. The cost of producing the base is \$0.08 per square inch or $(3x^2) \times (0.08) = 0.24x^2$.
- The area of each of the longer of the vertical sides is $(3x)(1.5x) = 4.5x^2$. Since there are two of these sides and the cost per square inch is \$0.03, the cost of these two sides is $2(4.5x^2)(0.03) = 0.27x^2$.
- The area of each of the shorter vertical sides is $(x)(1.5x) = 1.5x^2$. Since there are two of these sides and the cost per square inch is \$0.03, the cost of these two sides is $2(1.5x^2)(0.03) = 0.09x^2$.

The cost of producing the box is $0.24x^2 + 0.27x^2 + 0.09x^2 = 0.60x^2$.

27. **(C)** The given inequality $|o - p| \leq d$ represents the condition that the data points of interest must fall within 0.5 cm either above or below the line. Of the 12 plotted points on the scatterplot, 4 points satisfy this condition so the proportion or ratio is $\frac{4}{12}$ or $\frac{1}{3}$.

28. **(B)** To determine the width of the arch, find the distance between the x -intercepts of the parabola by setting $y = 0$: $0 = -3x(x - 8)$ so the x -intercepts are 0 and 8. The width of the base of the arch is $8 - 0 = 8$. To find the height of the arch, find the y -coordinate of the vertex of the parabola. For the parabola $y = ax^2 + bx + c$, the formula $x = -\frac{b}{2a}$ gives the x -coordinate of the vertex:

$$x = -\frac{24}{2(-3)} = 4$$

To find the y -coordinate of the vertex, substitute 4 for x in the parabola equation:

$$\begin{aligned} y &= -3(4)^2 + 24(4) \\ &= -48 + 96 \\ &= 48 \end{aligned}$$

Since the height of the parabola is 48 meters and its width is 8 meters, the height is 6 times the width.

29. **(A)** Randomly placing calls to as many potential residents as possible will result in the most random, representative sample of the population. All of the other options place significant limitations on the range of potential voters surveyed.

30. **(B)**

- The sum of the areas of the two squares is $36 + 36 = 72$.
- To find the area, A , of a regular hexagon with side s , multiply the area of one of the equilateral triangles that comprises the hexagon by 6:

$$\begin{aligned} A &= 6 \times \left(\frac{s^2 \sqrt{3}}{4} \right) \\ &= 6 \times \left(\frac{36 \sqrt{3}}{4} \right) \\ &= 54 \sqrt{3} \end{aligned}$$

- The percent of the total surface area that will be silver plated is the ratio of the areas of the two squares to the total area:

$$\frac{72}{72 + 54 \sqrt{3}} \approx 43.5 \approx 44\%$$

31. **(22)** Change to ounces:

- Find the equivalent number of ounces in the 225 milliliter (ml) bottle:

$$225 \text{ ml} \div 29.6 \frac{\text{ml}}{\text{ounce}} = 7.6 \text{ ounces}$$

- Find the number of ounces equivalent to two teaspoons:

1 cup = 16 tablespoons = 16×3 teaspoons = 48 teaspoons = 8 ounces.

Divide each side of the equation by 24, which shows that 2 teaspoons are

equivalent to $\frac{8}{24} = \frac{1}{3}$ ounce.

- Since $7.6 \div \frac{1}{3} = 22.8$, the maximum number of 2-teaspoon doses is 22.

32. **(270)** Use the relationship that $\text{time} = \frac{\text{distance}}{\text{rate}}$:

$$\begin{aligned} \text{time} &= \frac{3.06 \times 10^9}{1.86 \times 10^5} \\ &\approx 1.64516 \times 10^4 \\ &\approx 16,451.6 \text{ seconds} \\ &\approx \frac{16,451.6}{60} \text{ minutes} \\ &\approx 274.2 \text{ minutes} \end{aligned}$$

Rounding to the nearest 5 minutes, the time is 275 minutes.

33. **(8/15)** In the unit circle given,

$$\blacksquare \tan \theta = \frac{y}{x} = \frac{-0.8}{-0.6} = \frac{4}{3}$$

$$\blacksquare \sin \theta = y = -0.8$$

$$\begin{aligned} \blacksquare \tan \theta + \sin \theta &= \frac{4}{3} - 0.8 \\ &= \frac{4}{3} - \frac{4}{5} \\ &= \frac{20}{15} - \frac{12}{15} \\ &= \frac{8}{15} \end{aligned}$$

34. **(11)** If $a + 2b = 13$ and $8a + b = 20$, then adding corresponding sides of the two equations gives $9a + 3b = 33$. If each member of $9a + 3b = 33$ is divided by 3, then $3a + b = 11$.
35. **(90)** If x represents the number of sports fans that needs to be added, then

$$\begin{aligned} \frac{120 + x}{120 + 75 + 65 + x} &= \frac{3}{5} \\ \frac{120 + x}{260 + x} &= \frac{3}{5} \\ 5(120 + x) &= 3(260 + x) \\ 600 + 5x &= 780 + 3x \\ 5x - 3x &= 780 - 600 \\ 2x &= 180 \\ x &= \frac{180}{2} = 90 \end{aligned}$$

36. **(345)** If x represents the minimum number of surgeries that need to be performed to make a profit, then

$$\begin{aligned} 2,000x - (500,000 + 550x) &> 0 \\ 1,450x &> 500,000 \\ x &> \frac{500,000}{1,450} \\ x &> 344.83 \end{aligned}$$

Since x must be an integer greater than 344, the minimum value of x is 345.

37. **(2,895)** Use the percent rates of increase in the CPI from the table as the corresponding rates of inflation. Call p the price of the appliance at the beginning of 2012. Multiply p by $(1 + \text{inflation rate})$ for 2012 and multiply the result by $(1 + \text{inflation rate})$ for 2013 to arrive at the final cost of 3,000 in 2014:

$$\begin{aligned} (p \times 1.021) \times 1.015 &= 3,000 \\ p &= \frac{3,000}{1.021 \times 1.015} \\ p &\approx 2,894.87 \end{aligned}$$

The cost of the appliance in 2012, to the *nearest dollar*, would have been \$2,895.

38. (5) Use the CPI rate increases as the rates for inflation for the time specified in the problem. In the second half of 2005, the inflation rate is 3.8% for the 6 month period; in 2006 it was 3.2%; in 2007 it was 2.8%; and in the first half of 2008 it was 4.2% for the 6 month period. Calculate the compounded rate of inflation over this three year time period by using 100 as an initial base amount:

- Using the base amount of 100, for the second *half* of 2005, the amount increases to

$$100 + 0.038 \times 100 \times \frac{1}{2} = 101.9.$$

- The final amount at the end of 2006 is $101.9(1 + 0.032) = 105.16$.
- The final amount at the end of 2007 is $105.16(1 + 0.028) = 108.10$.
- The final amount at the end of the first *half* year in 2008 is

$$108.10 + 108.10 \times 0.042 \times \frac{1}{2} = 110.37.$$

Since the initial amount increased from 100 to 110.37, the compounded rate of inflation over the three year period was 10.37%. The average yearly compounded rate of inflation over the three years is $\frac{10.37\%}{3} \approx 3.46\%$. Since $1.5\% + 3.46\% = 4.96\%$,

the minimum annual rate of increase in his monthly annuity payments, *correct to the nearest tenth* should be 5.0%.

MATHEMATICS TEST—NO CALCULATOR

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

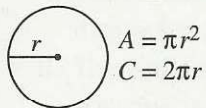
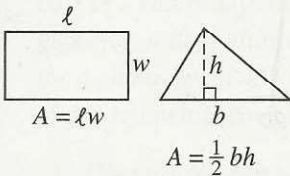
Directions: For questions 1-15, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 16-20, solve the problem and fill in the answer on the answer sheet grid.

Notes:

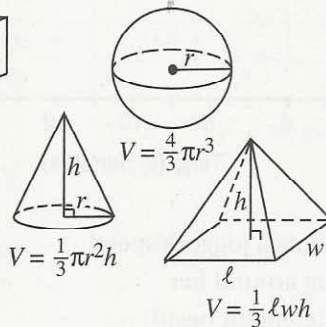
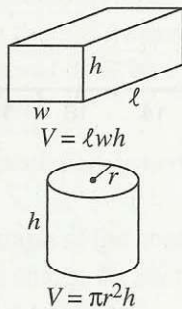
- Calculators are **NOT PERMITTED** in this section.
- All variables and expressions represent real numbers unless indicated otherwise.
- All figures are drawn to scale unless indicated otherwise.
- All figures are in a plane unless indicated otherwise.
- Unless indicated otherwise, the domain of a given function is the set of all real numbers x for which the function has real values.

REFERENCE INFORMATION

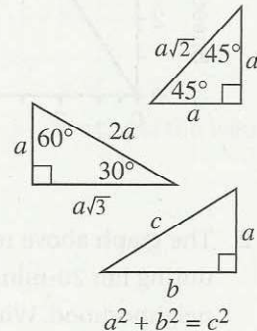
Area Facts



Volume Facts



Triangle Facts



The arc of a circle contains 360° .
 The arc of a circle contains 2π radians.
 The sum of the measures of the angles in a triangle is 180° .

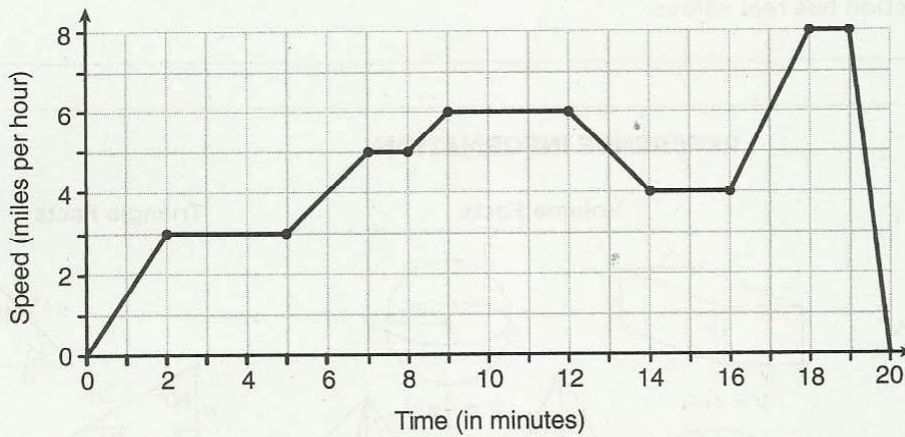
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$$\frac{5x - 3y}{3x + 5y} + \frac{2}{3} = 1$$

1. In the equation above, what is the value

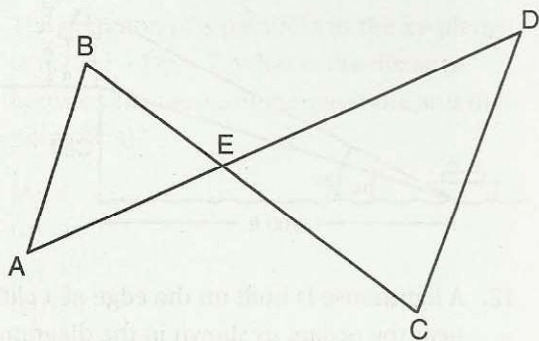
of $\frac{x}{y}$?

- (A) $\frac{1}{3}$
 (B) $\frac{2}{3}$
 (C) $\frac{5}{6}$
 (D) $\frac{7}{6}$



2. The graph above represents a jogger's speed during her 20-minute jog around her neighborhood. Which statement best describes what the jogger was doing during the 9–12 minute interval of her jog?

- (A) She was standing still.
 (B) She was increasing her speed.
 (C) She was decreasing her speed.
 (D) She was jogging at a constant rate.



Note: Figure is not drawn to scale.

3. In the figure above, $\overline{AB} \parallel \overline{CD}$, $AD = 42$, $AB = 12$, and $CD = 16$. What is the length of \overline{DE} ?
- (A) 21
 (B) 24
 (C) 27
 (D) 30

$$C = 60 + 0.25d$$

4. The equation above represents the monthly cost of a cell phone that includes up to 1 gigabyte of data after which there is a charge for d gigabytes of any additional data. Which of the following must be true?
- I. The cost of each additional megabyte of data is \$60.25.
 II. The y -intercept of the graph of the cost equation represents the charge for each additional megabyte of data used.
 III. If between 5 and 6 megabytes of data are used in a month, the monthly charge is \$61.25.
- (A) I and II only
 (B) I and III only
 (C) II only
 (D) III only

5. For what set of values of x is the expression $|3x + 4| < 0$ true?

- (A) $-\frac{4}{3} < 0 < x$
 (B) $x < -\frac{4}{3}$
 (C) No real numbers
 (D) All real numbers

6. The distance a free falling object has traveled can be modeled by the equation $d = \frac{1}{2}at^2$

where a is acceleration due to gravity and t is the amount of time the object has fallen. What is t in terms of a and d ?

- (A) $t = \sqrt{\frac{da}{2}}$
 (B) $t = \sqrt{\frac{2d}{a}}$
 (C) $t = \left(\frac{da}{2}\right)^2$
 (D) $t = \left(\frac{2d}{a}\right)^2$

7. If $x^2 - y^2 = 24$ and $x - y = 3$, what is the value of y ?

- (A) $\frac{1}{2}$
 (B) $\frac{3}{2}$
 (C) $\frac{7}{4}$
 (D) $\frac{5}{2}$

8. If $\frac{z}{2b} = 4$, $\frac{z}{2c} = 6$, and $2b + 3c = 12$, what is the value of z ?

- (A) 16
 (B) 20
 (C) 24
 (D) 48

GO ON TO THE NEXT PAGE

9. A pizza parlor has a fixed initial cost of \$180,000, and a variable cost of \$4 for each pizza sold. If the pizza parlor charges \$10 for each pizza, how many pizzas will it have to sell before it makes a profit?

(A) 24,000
 (B) 30,000
 (C) 38,000
 (D) 42,000

$$(ax + 7)(bx - 1) = 12x^2 + kx + (b - 13)$$

10. If the equation above is true for all values of x where a , b , and k are non-zero constants, what is the value of k ?

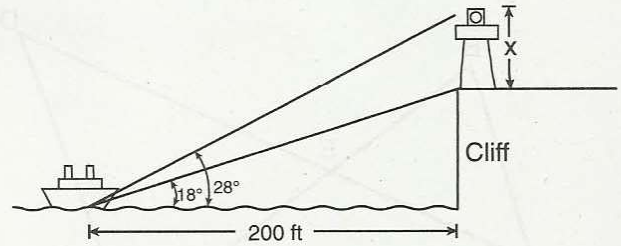
(A) 40
 (B) 25
 (C) 17
 (D) 8

11. Function f is defined by the equation

$$f(x) = ax^2 + \frac{2}{a}x. \text{ If } f(3) - f(2) = 11, \text{ what is}$$

the *smallest* possible value of a ?

(A) $\frac{1}{6}$
 (B) $\frac{1}{5}$
 (C) $\frac{1}{2}$
 (D) 2



12. A lighthouse is built on the edge of a cliff near the ocean, as shown in the diagram above. From a boat located 200 feet from the base of the cliff, the angle of elevation to the top of the cliff is 18° and the angle of elevation to the top of the lighthouse is 28° . Which of the following equations could be used to find the height of the lighthouse, x , in feet?

(A) $x = 200 \tan 10^\circ$
 (B) $x = 200(\tan 28^\circ - \tan 18^\circ)$
 (C) $x = \frac{200}{(\tan 28^\circ - \tan 18^\circ)}$
 (D) $x = 200 \left(\frac{\tan 18^\circ}{\tan 28^\circ} \right)$

13. The local deli charges a fee for delivery. On Monday, they delivered two dozen bagels to an office at a total cost of \$8. On Tuesday, three dozen bagels were delivered at a total cost of \$11. Which system of equations could be used to find the cost of a dozen bagels, b , if the delivery fee is f ?

(A) $b + 2f = 8$
 $b + 3f = 11$
 (B) $2b + f = 8$
 $b + 3f = 11$
 (C) $b + 2f = 8$
 $3b + f = 11$
 (D) $2b + f = 8$
 $3b + f = 11$

GO ON TO THE NEXT PAGE

14. The equation of a parabola in the xy -plane is $y = 2x^2 - 12x + 7$. What is the distance between the vertex of the parabola and the point $(3, 4)$?
- (A) 6
(B) 8
(C) 11
(D) 15
15. When a baseball is hit by a batter, the height of the ball, $h(t)$, at time t , is determined by the equation $h(t) = -16t^2 + 64t + 4$ where $t \geq 0$. For which interval of time, in seconds, is the height of the ball at least 52 feet above the playing field?
- (A) $0.5 \leq t \leq 2.5$
(B) $1.0 \leq t \leq 3.0$
(C) $1.5 \leq t \leq 3.5$
(D) $2.0 \leq t \leq 4.0$

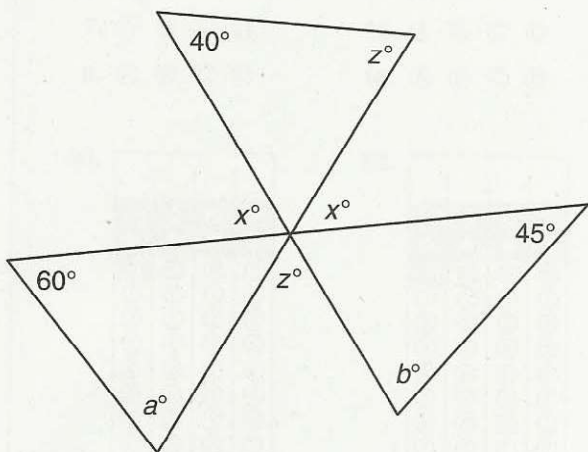
$$\frac{\frac{2}{3}a^2 - \frac{4}{9}a^2}{2a} = 4 \quad \text{where } a \neq 0$$

16. What is the value of a in the expression above?

$$\frac{2}{3}x - \frac{1}{4}y = 6$$

$$kx - \frac{1}{3}y = 8$$

17. If the system of equations above has an infinite number of solutions, what is the value of the constant k ?



18. In the figure above, the measures of the angles are as marked. What is the value of $a + b$?

19. The equation $W = 120I - 12I^2$ represents the power, W , in watts, of a 120-volt circuit having a resistance of 12 ohms when a current, I , is flowing through the circuit. What is the maximum power, in watts, that can be delivered in this circuit?
20. The graph of a line in the xy -plane passes through the points $(5, -5)$ and $(1, 3)$. The graph of a second line has a slope of 6 and passes through the point $(0, 1)$. If the two lines intersect at (p, q) , what is the value of $p + q$?

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MATHEMATICS TEST—CALCULATOR

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

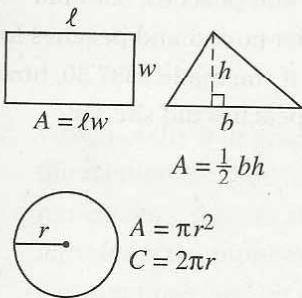
Directions: For questions 1–30, solve each problem and choose the best answer from the given options. Fill in the corresponding circle on your answer document. For questions 31–38, solve the problem and fill in the answer on the answer sheet grid.

Notes:

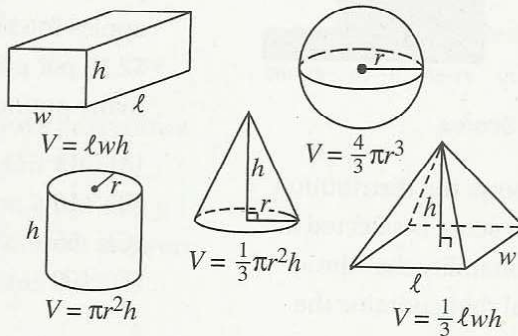
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REFERENCE INFORMATION

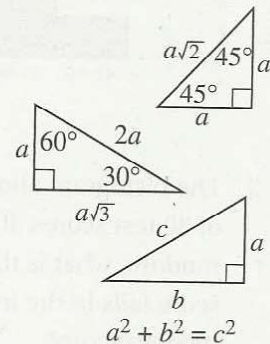
Area Facts



Volume Facts



Triangle Facts



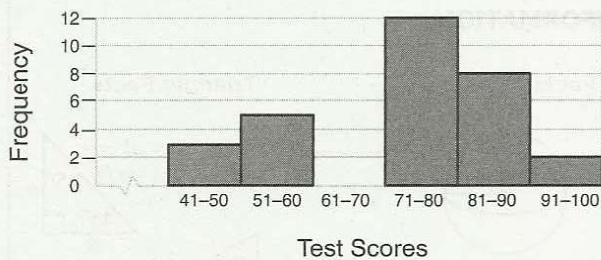
The arc of a circle contains 360° .

The arc of a circle contains 2π radians.

The sum of the measures of the angles in a triangle is 180° .

GO ON TO THE NEXT PAGE

- If three times 1 less than a number n is the same as two times the number increased by 14, what is the value of n ?
 - 15
 - 17
 - 19
 - 21
- George spent 25% of the money he had on lunch and 60% of the remaining money on dinner. If he then had \$9.00 left, how much money did he spend on lunch and dinner?
 - \$19
 - \$20
 - \$21
 - \$27



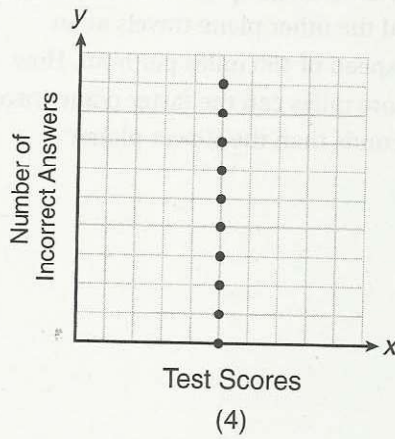
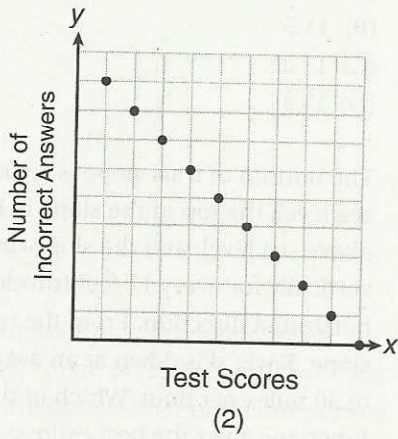
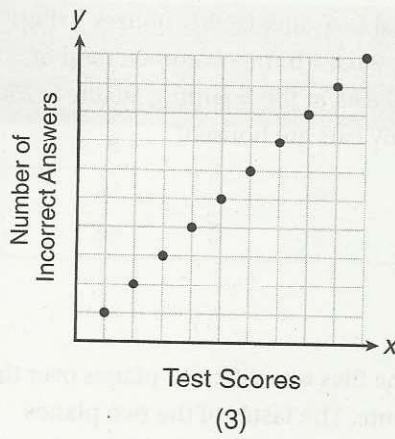
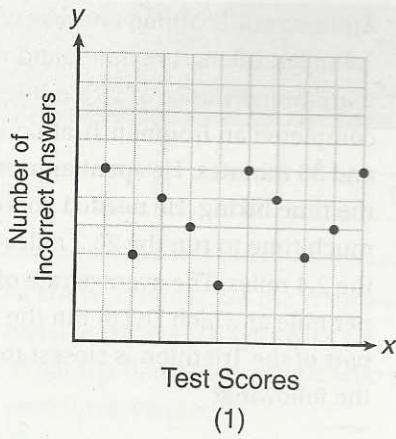
- The histogram above shows the distribution of 30 test scores. If a test score is selected at random, what is the probability that the score falls in the interval that contains the median score?
 - $\frac{4}{15}$
 - $\frac{2}{5}$
 - $\frac{1}{2}$
 - $\frac{3}{5}$

- The breakdown of a 500-milligram sample of a chemical compound in the bloodstream is represented by the function $p(n) = 500(0.8)^n$, where $p(n)$ represents the number of milligrams of the compound that remains at the end of n hours. Which of the following is true?
 - The amount of the compound present is decreasing by a constant amount.
 - Each hour the compound gets reduced by 20% of the amount present at the beginning of that hour.
 - Each hour the compound gets reduced by 80% of 500.
 - I only
 - II only
 - I and III only
 - II and III only
- Maggie's farm stand sold a total of 165 pounds of apples and peaches. She sold apples for \$1.75 per pound and peaches for \$2.50 per pound. If she made \$337.50, how many pounds of peaches did she sell?
 - 11
 - 18
 - 65
 - 100

Number of Weeks	1	2	3	4
Number of Downloads	120	180	270	405

- A computer program application developer released a new game app to be downloaded. The table above gives the number of downloads, y , for the first four weeks after the launch of the app. If w represents the number of weeks after the launch of the app, which equation best models these data?
 - $y = 60(w + 1)$
 - $y = 96(1.25)^w$
 - $y = 80(1.50)^w$
 - $y = 90w$

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7. Which of the four graphs above best shows the relationship between x and y if x represents a student score on a test and y represents the number of incorrect answers a student received on the same test?

- (A) Graph (1)
- (B) Graph (2)
- (C) Graph (3)
- (D) Graph (4)

8. An animal boarding facility houses 3 dogs for every 2 cats. If the combined total of dogs and cats at the boarding facility is 250, how many cats are housed?

(A) 80
(B) 100
(C) 120
(D) 150

9. An airline flies two different planes over the same route. The faster of the two planes travels at an average speed of 540 miles per hour, and the other plane travels at an average speed of 450 miles per hour. How many more miles can the faster plane travel in 12 seconds than the slower plane?

(A) $\frac{1}{5}$
(B) $\frac{3}{10}$
(C) 9
(D) 18

$$\begin{aligned}x - 3y &= 2y + 7 \\x + 2 &= 3(y + 1)\end{aligned}$$

10. In the above system of equations, what is the value of $\frac{x}{y}$?

(A) $\frac{8}{3}$
(B) $\frac{11}{3}$
(C) 4
(D) 12

11. An Ironman Triathlon consists of swimming 2.4 miles, biking 112 miles, and running a marathon distance of 26.2 miles. Dylan completed an Ironman Triathlon in 12 hours and 30 minutes. He spent approximately half the time biking. He needed about 4 times as much time to run the 26.2 miles as to swim the 2.4 miles. The average rate of minutes per mile at which Dylan ran the marathon part of the Triathlon is closest to which of the following?

(A) 10.6
(B) 11.5
(C) 12.2
(D) 13.4

12. The bottom of a ski slope is 6,500 feet above sea level, the top of the slope is 11,000 feet above sea level, and the slope drops 5 feet vertically for every 11 feet traveled in the horizontal direction. From the top of the slope, Kayla skis down at an average speed of 30 miles per hour. Which of the following functions gives the best estimate for the distance above sea level, d , Kayla is t seconds after she begins her ski run where $6,500 < d < 11,000$? [Note: 5,280 feet = 1 mile]

(A) $d(t) = 11,000 - \left(\frac{150}{11}\right)t$
(B) $d(t) = 11,000 - 2.2t$
(C) $d(t) = 11,000 - 20t$
(D) $d(t) = 4,500 - 1,200t$

13. A gardener is planting two types of trees. One type is seven feet tall and grows at a rate of 8 inches per year. The other type is four feet tall and its rate of growth is 50% greater than the rate of the other tree. In how many years will the two trees grow to the same height?

(A) 6
(B) 7
(C) 8
(D) 9

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Age	Vaccination and Flu Status				Total
	Unvaccinated No Flu	Unvaccinated Got Flu	Vaccinated No Flu	Vaccinated Got Flu	
Under 21	6	4	8	2	20
21-50	17	15	22	14	68
Over 50	2	9	32	19	62

14. The table above summarizes the results of a survey taken at the end of last year's flu season. What fraction of the people who got the flu were unvaccinated?

- (A) $\frac{2}{3}$
- (B) $\frac{4}{9}$
- (C) $\frac{3}{8}$
- (D) $\frac{1}{12}$

15. The temperature, t , generated by an electrical circuit is represented by $t = f(m) = 0.3m^2$, where m is the number of moving parts. The resistance of the same circuit is represented by $r = g(t) = 150 + 5t$, where t is the temperature. What is the resistance in a circuit that has four moving parts?

- (A) 51
- (B) 156
- (C) 174
- (D) 8,670

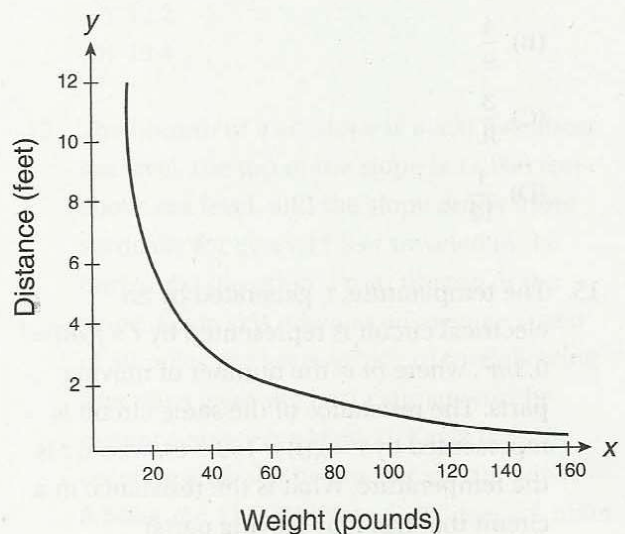
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Comparison of Combined State and Local Spending on Education						
State	Year					
	2011		2013		2015	
	Education Spending	Population	Education Spending	Population	Education Spending	Population
California	453,480.7	37.7	447,531.1	38.4	454,003.1	39.2
New York	300,031.9	19.5	306,395.8	19.7	316,104.0	19.8
Texas	221,155.9	25.7	226,805.0	26.5	252,655.5	27.4
Florida	163,070.8	19.1	157,010.2	19.6	162,548.3	20.2
Illinois	129,543.3	12.9	132,848.8	12.9	140,072.6	12.9

Questions 16 and 17 refer to the above table, that shows the population (in millions) and education spending (in millions) and by state for each of the states listed for the years 2011, 2013, and 2015.

16. Which of the following best approximates the average rate of change in education spending in Texas from 2011 to 2015 ?
- (A) 3.2 billion per year
 (B) 6.3 billion per year
 (C) 7.9 billion per year
 (D) 10.5 billion per year
17. Based on the data in the table, which of the following must be true?
- I. In 2015 per capita (per person) spending on education in Illinois was greater than per capita spending on education in Texas.
 II. Per capita spending on education in Florida declined in 2015 compared to 2011 spending.
 III. California had the highest per capita spending in education for each year.
- (A) I and II only
 (B) I and III only
 (C) II and III only
 (D) I, II, and III

18.



The graph above shows the relationship between a person's weight and the distance that the person must sit from the center of a seesaw to make it balanced. Which of the following best represents the equation of this graph?

- (A) $y = 12x^2$
 (B) $y = -120x$
 (C) $y = 120\left(\frac{1}{2}\right)^x$
 (D) $y = \frac{120}{x}$

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Average Annual Salary Range By Highest Level of Degree Earned				
Highest Degree Earned	Average Annual Salary			Total
	Less than \$35,000	\$35,000 to \$70,000	More than \$70,000	
High School	21	15	3	39
Two Year College	12	24	2	33
Four Year College	18	41	29	93
Graduate School	1	28	46	75
Total	52	108	80	240

19. The table above summarizes the results of a survey taken in which 240 adults were asked about their education level and current annual salary. If a participant who reported earning \$35,000 or more per year is selected at random, what is the best estimate of the probability that the person does *not* have a graduate school degree?
- (A) 0.31
 (B) 0.40
 (C) 0.60
 (D) 0.69
20. If the sum of 10 dimes, 5 nickels, and x quarters equals \$5.25, what is the value of x ?
- (A) 8
 (B) 10
 (C) 16
 (D) 22

Students at Washington High School	Male	Female	Total
Taking AP Classes	56	72	128
Not Taking AP Classes	23	26	49
Total	79	98	177

21. The table above gives the number of male and female students at Washington High School who are taking Advanced Placement (AP) classes and those who are not. What is the proportion of the total number of students at the school who are both male and NOT taking AP classes?
- (A) $\frac{23}{177}$
 (B) $\frac{79}{177}$
 (C) $\frac{23}{49}$
 (D) $\frac{23}{56}$
22. A travel agency sells ship cruises for a popular cruise line. Historically, 135 cruises can be sold when the price is \$950 per person. If the price drops to the minimum allowed by the cruise line of \$725 per person, 180 cruises can be sold. If the number of cruises sold increases at a constant rate as the price p decreases, where $p \geq 725$, which of the following functions best models the situation described?
- (A) $f(p) = -\frac{1}{29}p + 205$
 (B) $f(p) = -\frac{1}{19}p + 1,135$
 (C) $f(p) = -5p + 4,885$
 (D) $f(p) = -\frac{1}{5}p + 325$

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- I. The coordinates of the center are $(2, -3)$.
 II. The coordinates of the center are $(-2, 3)$.
 III. The length of the radius is $5\sqrt{2}$.
 IV. The length of the radius is 50.

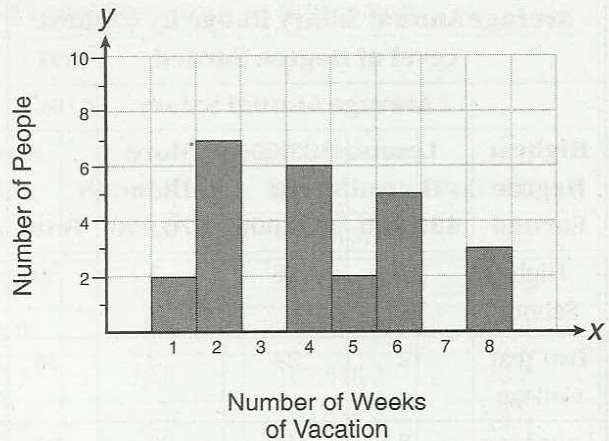
23. If an equation of a circle is $x^2 + 4x + y^2 - 6y = 37$, which of the statements above are true?

- (A) I and III
 (B) I and IV
 (C) II and III
 (D) II and IV

$$f(x) = \frac{x^4 + 2x^3 - 3x^2 + 4x + 12}{x + 3}$$

24. Which of the following functions is equivalent to the function above for all values of x for which function f is defined?

- (A) $g(x) = x^3 - x^2 + 4$
 (B) $g(x) = x^2 - x + 4$
 (C) $g(x) = x^3 - x^2 + 4x$
 (D) $g(x) = x^4 + 2x^3 - 3x^2 + 4$



25. The histogram above shows the results of a survey taken of 25 individuals who were polled about how many weeks of vacation per year they receive. Which of the following is closest to the average (arithmetic mean) number of weeks of vacation per individual?

- (A) 2
 (B) 3
 (C) 4
 (D) 5

26. If $p(x)$ is a polynomial function and $p(-1) = 3$, which statement is true?

- (A) The remainder when $p(x)$ is divided by $x - 3$ is -1 .
 (B) The remainder when $p(x)$ is divided by $x + 3$ is -1 .
 (C) The remainder when $p(x)$ is divided by $x - 1$ is 3.
 (D) The remainder when $p(x)$ is divided by $x + 1$ is 3.

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$$y = \frac{3}{h-2}x + 5$$
$$hy - 8x = 5$$

27. For what value of h does the system of equations above have no solution?

- (A) $\frac{16}{5}$
- (B) $\frac{13}{8}$
- (C) $\frac{11}{15}$
- (D) $\frac{5}{8}$

28. A troy ounce is a unit of mass used for precious metals such as gold. There are 12 troy ounces in a troy pound and a troy pound is equivalent to 373.2 grams. If the density of gold is 19.3 grams per cubic centimeter, which of the following is closest to the number of cubic centimeters in the volume of a block of gold with a mass of 5 troy ounces? [Note: density is mass divided by volume]

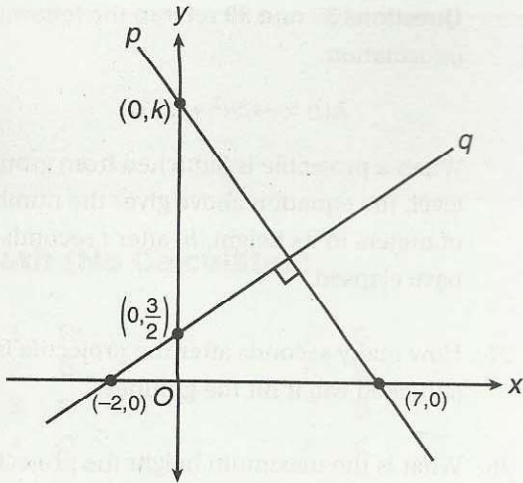
- (A) 7
- (B) 8
- (C) 9
- (D) 10

29. A researcher is conducting a survey for which she currently has a 93% confidence level. What would be two actions that she could take that would be most likely to increase the confidence level in her survey results?

- (A) Increase the sample size and modify the design of the survey to increase the standard deviation.
- (B) Increase the sample size and modify the design of the survey to decrease the standard deviation.
- (C) Decrease the sample size and increase the randomness of the survey sample.
- (D) Modify the design of the survey to increase the standard deviation and decrease the randomness of the survey sample.

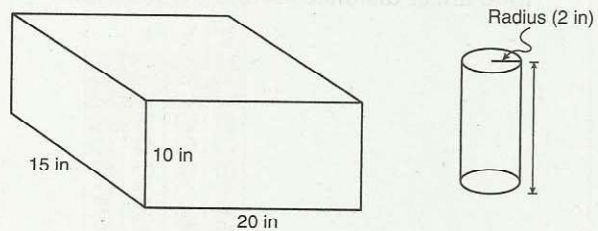
30. The coordinates of the vertex of a parabola in the xy -plane are $(-4, k)$. If the y -intercept of the parabola is 12 and the parabola passes through the point $(-3, 7)$, what is the value of k ?

- (A) $\frac{20}{3}$
- (B) $\frac{16}{5}$
- (C) $\frac{14}{3}$
- (D) $\frac{12}{5}$



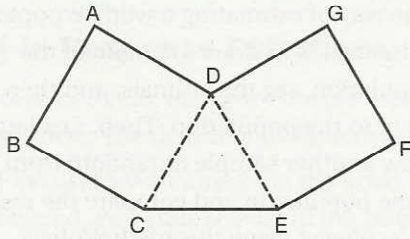
31. In the xy -plane above, line p is perpendicular to line q . What is the value of k ?
32. Eleven seconds after a deep sea diver jumps into the ocean he is 69 feet below sea level and 28 seconds later, he is 195 feet below sea level. If he is descending under water at a constant rate, how many feet below sea level will he be 1.5 minutes after his initial descent?
33. What is a possible value of x that satisfies $9 < 4x - |-3| < 10$?

34. One way of estimating a wildlife population of interest is to draw a sample of the population, tag the animals, and then return them to the population. Then, at a later date, draw another sample at random from the same population and compare the results. An ecologist using this methodology captures, tags, and then returns 198 fish to a lake. Three months later the ecologist captures a sample of 135 of the same type of fish, of which 22 were tagged. What would be the ecologist's best estimate for the number of fish of that type that are in the lake?



35. In the figure above, a rectangular container with the dimensions 10 inches by 15 inches by 20 inches is to be filled with water, using a cylindrical cup whose radius is 2 inches and whose height is 5 inches. What is the maximum number of full cups of water that can be placed into the container without the water overflowing the container?

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36. A sterling silver pendant is being designed to have the shape of polygon $ABCEFGD$ shown above where $ABCD$ and $EFGD$ are squares and triangle CDE is equilateral. If the area of $\triangle CDE$ is $\frac{27}{\sqrt{3}}$ square centimeters, what is the total linear distance around the pendant?

Questions 37 and 38 refer to the following information.

$$h(t) = -4.9t^2 + 88.2t$$

When a projectile is launched from ground level, the equation above gives the number of meters in its height, h , after t seconds have elapsed.

37. How many seconds after the projectile is launched will it hit the ground?
38. What is the maximum height the projectile reaches, correct to the nearest meter?

ANSWER KEY

Practice Test 2

Math (No Calculator)

- | | | | |
|-------------|-------------|--------------|--------------|
| 1. D | 5. C | 9. B | 13. D |
| 2. D | 6. B | 10. A | 14. D |
| 3. B | 7. D | 11. B | 15. B |
| 4. D | 8. C | 12. B | |

16.

		3	6
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3	3	3	3
4	4	4	4
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6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

17.

	8	/	9
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2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

18.

	1	4	5
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2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

19.

	3	0	0
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3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

20.

	9	/	2
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3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

ANSWER KEY

Practice Test 2

Math (Calculator)

- 1. **B**
- 2. **C**
- 3. **B**
- 4. **B**
- 5. **C**
- 6. **C**
- 7. **B**
- 8. **B**

- 9. **B**
- 10. **A**
- 11. **B**
- 12. **C**
- 13. **D**
- 14. **B**
- 15. **C**
- 16. **C**

- 17. **A**
- 18. **D**
- 19. **C**
- 20. **C**
- 21. **A**
- 22. **D**
- 23. **C**
- 24. **A**

- 25. **C**
- 26. **D**
- 27. **A**
- 28. **B**
- 29. **B**
- 30. **A**

31.

2	8	/	3
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6	6	6	6
7	7	7	7
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9	9	9	9

32.

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9	9	9	9

33.

	3	.	2
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7	7	7	7
8	8	8	8
9	9	9	9

34.

1	2	1	5
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8	8	8	8
9	9	9	9

35.

		4	7
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9	9	9	9

36.

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6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

37.

		1	8
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9	9	9	9

38.

	3	9	7
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4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	<input checked="" type="radio"/>
8	8	8	8
9	<input checked="" type="radio"/>	9	9

ANSWER EXPLANATIONS FOR PRACTICE TEST 2

No-Calculator Section

1. **(D)** Subtract $\frac{2}{3}$ from both sides of the equation, and then set the cross-products equal:

$$\begin{aligned}\frac{5x - 3y}{3x + 5y} &= \frac{1}{3} \\ 3(5x - 3y) &= 3x + 5y \\ 15x - 9y &= 3x + 5y \quad \leftarrow \text{Collect like variables} \\ 12x &= 14y \quad \leftarrow \text{Divide both sides by } 12y \\ \frac{x}{y} &= \frac{14}{12} = \frac{7}{6}\end{aligned}$$

2. **(D)** During the 9–12 minute interval, the graph is horizontal. Speed is being measured along the vertical axis, and there is no change in speed. As a result, the runner is jogging at a constant rate.
3. **(B)** Since $\triangle AEB$ is similar to $\triangle DEC$, the lengths of their corresponding sides are in proportion. If x represents the length of \overline{DE} , then $42 - x$ represents the length of \overline{AE} . Thus,

$$\begin{aligned}\frac{CD}{AB} &= \frac{DE}{AE} \\ \frac{16}{12} &= \frac{x}{42 - x} \\ \frac{4}{3} &= \frac{x}{42 - x} \quad \leftarrow \text{cross-multiply} \\ 3x &= 4(42 - x) \\ 3x &= 168 - 4x \\ 7x &= 168 \\ x &= \frac{168}{7} \\ &= 24\end{aligned}$$

4. **(D)** In the equation $C = 60 + 0.25d$, d represents the number of gigabytes of data used after the first gigabyte and its coefficient, 0.25, must therefore represent the rate at which the cost, C , changes each time d increases by 1. Consider each statement in turn.
- I. The cost of each additional megabyte of data is not \$60.25, it is \$0.25. **X**
 - II. The y -intercept of the graph of $C = 60 + 0.25d$ is 60, which represents the fixed cost when there are no additional gigabytes of data used so it does not represent the cost of each additional gigabyte of data used. **X**
 - III. If between 5 and 6 megabytes of data are used in a month, and since the plan comes with the first megabyte of data free, then there is a charge for 5 rather than 6 gigabytes of data. Hence, $C = 60 + 0.25(5) = \$61.25$. This statement is true. **✓**
5. **(C)** The absolute value of a number cannot be less than zero. Therefore, it is impossible for there to be any numbers for which this statement can be true, since the absolute value of an expression cannot be a negative number.

6. **(B)** If $d = \frac{1}{2}at^2$, then $at^2 = 2d$ and $t^2 = \frac{2d}{a}$ so $t = \sqrt{\frac{2d}{a}}$.
7. **(D)** If $x^2 - y^2 = 24$, then $(x - y)(x + y) = 24$. Because it is given that $x - y = 3$, $x + y = 8$. Adding corresponding sides of the two linear equations gives $2x = 11$ so $x = \frac{11}{2}$. Substitute $\frac{11}{2}$ for x in $x + y = 8$: $\frac{11}{2} + y = 8$ so $y = 8 - \frac{11}{2} = \frac{16}{2} - \frac{11}{2} = \frac{5}{2}$.
8. **(C)** If $\frac{z}{2b} = 4$ and $\frac{z}{2c} = 6$, then $z = 8b$ and $z = 12c$. Adding corresponding sides of the two equations gives $2z = 8b + 12c$. Dividing each member of the equation by 2 makes $z = 4b + 6c = 2(2b + 3c) = 2(12) = 24$.
9. **(B)** To break even, the pizza parlor must have a profit of at least zero. Profit is calculated as *Revenue* - *Cost*. The total revenue is 10 dollars for each pizza, and the total cost is 4 dollars for each pizza plus the initial \$180,000 fixed cost. Express this algebraically, using p as the number of pizzas sold:

$$\begin{aligned} 10p - (4p + 180,000) &= 0 \\ 6p - 180,000 &= 0 \\ 6p &= 180,000 \\ p &= \frac{180,000}{6} = 30,000 \end{aligned}$$

10. **(A)** Since the product of the last terms of the binomial factors must be equal to -7 : $b - 13 = -7$ so $b = 6$. The product of the first terms of the binomials factors must be 12, the coefficient of the x^2 -term so $a = 2$. Hence,

$$\begin{aligned} (2x + 7)(6x - 1) &= 12x^2 - 2x + 42x - 7 \\ &= 12x^2 + 40x - 7 \end{aligned}$$

Since k is the coefficient of the x -term, $k = 40$.

11. **(B)** It is given that $f(x) = ax^2 + \frac{2}{a}x$. Then $f(3) = 9a + \frac{6}{a}$ and $f(2) = 4a + \frac{4}{a}$ so

$$f(3) - f(2) = \left(9a + \frac{6}{a}\right) - \left(4a + \frac{4}{a}\right) = 11. \text{ Simplify:}$$

$$5a + \frac{2}{a} = 11 \quad \leftarrow \text{Multiply each term by } a$$

$$5a^2 - 11a + 2 = 0 \quad \leftarrow \text{Solve by factoring}$$

$$(5a - 1)(a - 2) = 0$$

$$5a - 1 = 0 \quad \text{or} \quad a - 2 = 0$$

$$a = \frac{1}{5} \quad \text{or} \quad a = 2$$

Hence, the smallest possible value of a is $\frac{1}{5}$.

12. **(B)** The tangent of an acute angle of a right triangle is the length of the side opposite the angle divided by the length of the side adjacent to the angle. Hence,

$$\blacksquare \tan 28^\circ = \frac{x + \text{height of cliff}}{200} \text{ so height of cliff} + x = 200 \tan 28^\circ$$

$$\blacksquare \tan 18^\circ = \frac{\text{height of cliff}}{200} \text{ so height of cliff} = 200 \tan 18^\circ$$

- Subtracting corresponding sides of the previous two equations gives

$$\begin{aligned} x &= 200 \tan 28^\circ - 200 \tan 18^\circ \\ &= 200(\tan 28^\circ - \tan 18^\circ) \end{aligned}$$

13. **(D)** If b represents the cost of a dozen bagels and f is the delivery fee, then

- The cost of two dozen bagels plus delivery is $2b + f = 8$.
- The cost of three dozen bagels plus delivery is $3b + f = 11$.

14. **(D)** Find the vertex of the parabola $y = 2x^2 - 12x + 7$ by completing the square:

$$\begin{aligned} y &= 2x^2 - 12x + 7 \\ &= 2(x^2 - 6x) + 7 \\ &= 2(x^2 - 6x + 9) + 7 - 18 \\ &= 2(x - 3)^2 - 11 \end{aligned}$$

Hence, the vertex of the parabola is $(3, -11)$. The vertical distance between the vertex and $(3, 4)$ is $4 - (-11) = 4 + 11 = 15$.

15. **(B)** According to the conditions of the problem,

$$-16t^2 + 64t + 4 \geq 52$$

$$-16t^2 + 64t - 48 \geq 0 \quad \leftarrow \text{Divide each member by } -16$$

$$t^2 - 4t + 3 \leq 0 \quad \leftarrow \text{The direction of the inequality gets reversed}$$

$$(t - 1)(t - 3) \leq 0 \quad \leftarrow \text{Factors must have opposite signs}$$

$$t - 1 \geq 0 \quad \text{and} \quad t - 3 \leq 0$$

$$t \geq 1 \quad \text{and} \quad t \leq 3$$

Hence, the solution interval is $1.0 \leq t \leq 3.0$.

16. **36** Factor the numerator and divide out a :

$$\frac{a \cancel{\left(\frac{2}{3} - \frac{4}{9} \right)}}{2 \cancel{a}} = 4$$

$$a \left(\frac{2}{3} - \frac{4}{9} \right) = 8$$

$$a \left(\frac{6}{9} - \frac{4}{9} \right) = 8$$

$$a \left(\frac{2}{9} \right) = 8$$

$$a = \frac{9}{2} \times 8 = 36$$

17. Given $\frac{2}{3}x - \frac{1}{4}y = 6$ and $kx - \frac{1}{3}y = 8$.

If a system of linear equations has an infinite number of solutions, then the two equations can be made to look exactly the same.

- Multiply the first equation by 12 to eliminate the fractions:

$$12\left(\frac{2}{3}x - \frac{1}{4}y\right) = 12(6)$$

$$8x - 3y = 72$$

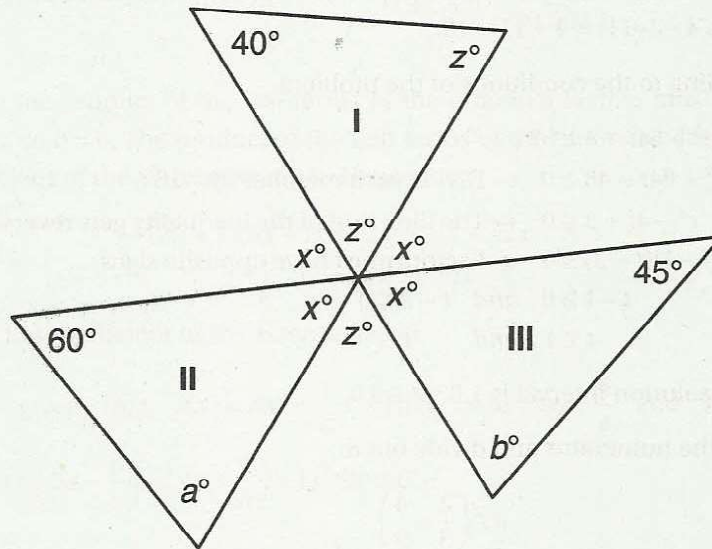
- Multiply the second equation by 9 so that the constant terms agree:

$$9\left(kx - \frac{1}{3}y\right) = 9(8)$$

$$9kx - 3y = 72$$

- The two equations will look the same when the coefficients of x are the same. Hence,
 $9k = 8$ so $k = \frac{8}{9}$.

18. (145) Since vertical angles have the same measure:



- In $\triangle I$, $2z + 40 = 180$ so $z = 70$.
 - $x + z + x = 180$ so $2x + 70 = 180$ and $x = 55$.
 - In $\triangle II$, $a + 60 + 55 = 180$ so $a = 65$. In $\triangle III$, $b + 45 + 55 = 180$ so $b = 80$.
- Hence, $a + b = 60 + 85 = 145$.

19. **(300)** The graph of the equation $W = 120I - 12I^2$ in the xy -plane is a parabola. To find the maximum value of W , find the y -coordinate of the vertex of the parabola:

$$\begin{aligned} W &= -12I^2 + 120I \\ &= -12(I^2 - 10I) \\ &= -12(I^2 - 10I + 25) + 300 \\ &= -12(I - 5)^2 + 300 \end{aligned}$$

Since the vertex of the parabola is at $(-5, 300)$, the maximum value of W is 300.

20. **(9/2)** The slope of the line through the points $(5, -5)$ and $(1, 3)$ is $\frac{3 - (-5)}{1 - 5} = \frac{8}{-4} = -2$.

The equation of the line through these two points has the form $y = -2x + b$. To find b , let $x = 1$ and $y = 3$. $3 = -2(1) + b$ so $b = 5$ and the equation of the line is $y = -2x + 5$. The equation of the line with slope 6 and which passes through $(0, 1)$ is $y = 6x + 1$. Find the coordinates of the intersection of the two lines by setting their y -values equal:

$$\begin{aligned} -2x + 5 &= 6x + 1 \\ 4 &= 8x \\ \frac{1}{2} &= x \end{aligned}$$

If $x = \frac{1}{2}$, then $y = 6\left(\frac{1}{2}\right) + 1 = 4$. If the lines intersect at (p, q) , then $(p, q) = \left(\frac{1}{2}, 4\right)$ so

$$p + q = \frac{1}{2} + 4 = \frac{9}{2}.$$

Calculator Section

- (B)** If three times 1 less than a number n ($3(n - 1)$) is the same as two times the number n increased by 14 ($2n + 14$), then $3n - 3 = 2n + 14$ so $3n - 2n = 14 + 3$ and $n = 17$.
- (C)** If x represents the amount of money George started with, then
 - $0.25x + 0.60(x - 0.25x) = 0.7x$ is the amount of money he spent on lunch and dinner.
 - The amount of money George had left is $x - 0.7x = 9$ so $0.3x = 9$ and $x = \frac{9}{0.30} = 30$.
 - The amount George spent on lunch and dinner is $0.7x = 0.7(30) = \$21$.
- (B)** Since there are 30 test scores, the median lies between the 15th score and 16th score, which are contained in the interval 71–80. This interval contains 12 of the 30 scores. Hence, the probability that a score picked at random will fall in the interval that contains the median is $\frac{12}{30} = \frac{2}{5}$.
- (B)** Consider each statement in turn.
 - I. The amount of the compound present is decreasing by a fixed percent of whatever amount remains, not by a constant amount. **X**
 - II. Since the base of the exponential function is 0.8 and $0.8 = 1 - 0.20 = 1 - 20\%$, each hour the compound gets reduced by 20% of the amount present. **✓**
 - III. Each hour the compound gets reduced by 20% of whatever is present rather than by the fixed amount of 80% of 500 so this statement is false. **X**

5. **(C)** If x represents the number of pounds of peaches sold, then $165 - x$ represents the number of pounds of apples sold. Thus,

$$\begin{aligned} 2.50x + 1.75(165 - x) &= 337.50 \\ 2.50x - 1.75x + 288.75 &= 337.50 \\ 0.75x &= 48.75 \\ x &= \frac{48.75}{0.75} = 65 \end{aligned}$$

6. **(C)** Test the equation in each of the answer choices for $x = 1$ to $x = 4$ to see if it produces the correct values for y for each of the given values of x . The equation in choice (C), $y = 80(1.50)^x$, is the only equation that works. For example, for $x = 4$, $y = 80(1.50)^4 = 80(5.0625) = 405$.
7. **(B)** Since the test score (x) must increase as the number of incorrect responses decreases (y), the linear pattern of dots must have a negative slope as in graph (2).
8. **(B)** The ratio of cats to the total number of cats and dogs is $\frac{2}{2+3} = \frac{2}{5}$. Set up a proportion to solve for the total number of cats:

$$\begin{aligned} \frac{2}{5} &= \frac{x}{250} \\ 5x &= 500 \\ x &= \frac{500}{5} = 100 \end{aligned}$$

9. **(B)** Since rate \times time = distance,

- Find the distance the faster plane travels:

$$\begin{aligned} 540 \frac{\text{miles}}{\text{hour}} \times 12 \text{ seconds} &= 540 \frac{\text{mi}}{\text{hr}} \times 12 \text{ sec} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ hr}}{60 \text{ min}} \\ &= 1.8 \text{ miles} \end{aligned}$$

- Find the distance the slower plane travels:

$$\begin{aligned} 450 \frac{\text{miles}}{\text{hour}} \times 12 \text{ seconds} &= 450 \frac{\text{mi}}{\text{hr}} \times 12 \text{ sec} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ hr}}{60 \text{ min}} \\ &= 1.5 \text{ miles} \end{aligned}$$

- The difference in the distances traveled is $1.8 - 1.5 = 0.3$ or $\frac{3}{10}$ miles.

10. **(A)** Simplify the equations:

$$\begin{aligned} x - 3y &= 2y + 7 &\Rightarrow x &= 5y + 7 \\ x + 2 &= 3(y + 1) &\Rightarrow x &= 3y + 1 \end{aligned}$$

Hence, $5y + 7 = 3y + 1$ so $2y = -6$ and $y = -3$. If $y = -3$, then $x = 3(-3) + 1 = -8$. The value

$$\text{of } \frac{x}{y} = \frac{-8}{-3} = \frac{8}{3}.$$

11. **(B)** The total amount of time swimming and running took one-half of the 12 hours and 30 minutes it took to complete the triathlon or 6 hours and 15 minutes. Let x represent the amount of time swimming and $4x$ represent the amount of time running the marathon. Then

$$\begin{aligned}x + 4x &= 6.25 \\5x &= 6.25 \\x &= \frac{6.25}{5} = 1.25 \\4x &= 4(1.25) = 5\end{aligned}$$

The 26.2 mile marathon distance was run in 5 hours or 300 minutes. Since $\frac{300}{26.2} \approx 11.45$, the average rate of minutes per mile at which Dylan ran the marathon is closest to 11.5.

12. **(C)** The rate of change in height when skiing from the top of the ski slope to its bottom is $-\frac{5}{11}$.

- Convert 30 miles per hour to feet per second:

$$30 \frac{\text{mi}}{\text{hr}} \times 5,280 \frac{\text{ft}}{\text{mi}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} = 44 \frac{\text{ft}}{\text{sec}}$$

- Multiplying $-\frac{5}{11}$ by $44 \frac{\text{ft}}{\text{sec}}$ gives the change in height per second of the skier.
- Thus, $d(t)$ is the difference between the starting height of 11,000 feet and the product formed by multiplying the rate at which height is decreasing per second times the number of seconds that have elapsed in the ski run:

$$\begin{aligned}d(t) &= 11,000 - \left(\frac{\text{change in height}}{\text{per second}} \right) (44) \times t \\&= 11,000 - 20t\end{aligned}$$

13. **(D)** If x represents the number of years it will take for the two trees to grow to the same height, then

$$84 + 8x = 48 + 12x$$

where each side of the equation represents the height of the tree in inches. Thus,

$$\begin{aligned}84 - 48 &= 12x - 8x \\36 &= 4x \\9 &= x\end{aligned}$$

14. **(B)** From the table, fill in the numbers to form the ratio:

$$\frac{(4 + 15 + 9)}{(4 + 15 + 9) + (2 + 14 + 19)} = \frac{28}{63} = \frac{4}{9}$$

15. **(C)** If the circuit has 4 moving parts, evaluate $f(4)$:

$$f(4) = 0.3(4)^2 = 4.8 = t.$$

Next, evaluate $g(4.8)$:

$$\begin{aligned}g(4.8) &= 150 + 5(4.8) \\ &= 150 + 24 \\ &= 174\end{aligned}$$

16. **(C)** For Texas,

$$\text{Rate of change} = \frac{7,900 - 221,155.9}{4} \approx \text{million}$$

To change from millions to billions, divide by 1,000, which gives 6.3 billion.

17. **(A)** Consider each statement in turn.

- I. In 2015, the per capita spending for Illinois was $\frac{140,072.6}{19.6} \approx 10,858$, which was greater than the per capita spending for Texas of $\frac{252,655.5}{27.4} \approx 9,221$. ✓
- II. Per capita spending in Florida in 2015 was $\frac{162,548.3}{20.2} \approx 8,047$, where as in 2011 it was $\frac{163,070.8}{19.1} \approx 8,538$ so it declined in 2015. ✓
- III. New York rather than California had the highest per capita spending for each year. ✗

18. **(D)** For each point along the curve, the product of x and y is 120. Hence, an equation of the graph is $xy = 120$ or, equivalently, $y = \frac{120}{x}$.

19. **(C)** Find the ratio of the number of individuals earning at least \$35,000 without a graduate school degree to the total number of individuals who earned at least \$35,000:

$$\begin{aligned}\frac{(108 - 28) + (80 - 46)}{108 + 80} &= \frac{80 + 34}{188} \\ &= \frac{114}{188} \\ &\approx 0.60\end{aligned}$$

20. **(C)** A dime is .1 dollars, and a nickel is .05 dollars, so the total money from the dimes and nickels is $.1 \times 10 + .05 \times 5 = 1.25$. So, the amount that must come from quarters is $5.25 - 1.25 = 4.00$. Since a quarter is .25 dollars, take 4.00 and divide it by .25: $\frac{4}{.25} = 16$.
21. **(A)** Divide the number of males not taking AP classes, 23, by the total number of students in the school, 177, to get $\frac{23}{177}$.

22. **(D)** Find the rate of change of cruises sold:

$$\frac{\Delta \text{cruises sold}}{\Delta \text{price}} = \frac{135 - 180}{950 - 725} = \frac{-45}{225} = -\frac{1}{5}$$

You can eliminate choices (A), (B), and (C).

23. **(C)** Write the equation $x^2 + 4x + y^2 - 6y = 37$ in center-radius form by completing the square for both variables:

$$\begin{aligned} x^2 + 4x + y^2 - 6y &= 37 \\ (x^2 + 4x + 4) + (y^2 - 6y + 9) &= 37 + 4 + 9 \\ (x + 2)^2 + (y - 3)^2 &= 50 \end{aligned}$$

Hence, the center of the circle is at $(-2, 3)$. Since $r^2 = 50$, $r = \sqrt{50} = \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$. The correct combination of statements is Statements II and III.

24. **(A)** Simplify the given function by factoring the numerator:

$$\begin{aligned} f(x) &= \frac{(x^4 + 2x^3 - 3x^2) + (4x + 12)}{x + 3} \\ &= \frac{x^2(x^2 + 2x - 3) + (4x + 12)}{x + 3} \\ &= \frac{x^2(x + 3)(x - 1) + 4(x + 3)}{x + 3} \\ &= \frac{(x + 3)[x^2(x - 1) + 4]}{x + 3} \\ &= x^3 - x^2 + 4 \end{aligned}$$

25. **(C)** Find the weighted average by calculating the sum of the products of the number of weeks of vacation and the number of people who receive the vacation, and then dividing the sum of the products by 25:

$$\begin{aligned} \frac{(1 \times 2) + (2 \times 7) + (4 \times 6) + (5 \times 2) + (6 \times 5) + (8 \times 3)}{25} &= \frac{104}{25} \\ &= 4.16 \\ &\approx 4 \end{aligned}$$

26. **(D)** If $p(x)$ is a polynomial function and $p(-1) = 3$, then when x is divided by $x - (-1)$ or, equivalently, $x + 1$, the remainder is 3.
27. **(A)** A system of linear equations has no solution if the graphs of the lines are parallel. Two lines are parallel when they have the same slope.

- If $hy - 8x = 5$, then $y = \frac{8}{h}x + \frac{5}{h}$ so the slope is $\frac{8}{h}$.
- If $y = \frac{3}{h-2}x + 5$, the slope is $\frac{3}{h-2}$.

- Find the value of h that makes the system of equations have no solution by setting the slopes equal:

$$\begin{aligned}\frac{3}{h-2} &= \frac{8}{h} \\ 8(h-2) &= 3h \\ 8h-16 &= 3h \\ 5h &= 16 \\ h &= \frac{16}{5}\end{aligned}$$

28. **(B)** Five troy ounces is equivalent to $\frac{5}{12} \times 373.2 = 155.5$ grams. Since density is mass divided by volume, V :

$$\begin{aligned}19.3 &= \frac{155.5}{V} \\ V &= \frac{155.5}{19.3} \approx 8.06\end{aligned}$$

The volume is closest to 8 cubic centimeters.

29. **(B)** To have an increase in the confidence level for survey results, the sample size should be as large as possible and the standard deviation should be as small as possible. A larger sample size will result in a data set that more completely mirrors the population, and if the standard deviation is low, the surveyor can be confident that there will not be great variation among the survey results.
30. **(A)** It is given that the vertex of a parabola is $(-4, k)$ so its equation is $y = a(x+4)^2 + k$. Since it is also given that the parabola contains the points $(0, 12)$ and $(-3, 7)$, the coordinates of these points must satisfy the parabola equation.

- For $(0, 12)$:

$$\begin{aligned}12 &= a(0+4)^2 + k \\ 12 &= 16a + k\end{aligned}$$

- For $(-3, 7)$:

$$\begin{aligned}7 &= a(-3+4)^2 + k \\ 7 &= a + k\end{aligned}$$

- Solve the two equations simultaneously for k . From the second equation, $a = 7 - k$. Substitute $7 - k$ for a in the first equation:

$$\begin{aligned}12 &= 16(7-k) + k \\ 12 &= 112 - 16k + k \\ 100 &= 15k \\ \frac{100}{15} &= k \\ \frac{20}{3} &= k\end{aligned}$$

31. **(28/3)** Find the slope of each line.

■ The slope of line p is $\frac{k-0}{0-7} = -\frac{k}{7}$.

■ The slope of line q is $\frac{3-0}{0-(-2)} = \frac{3}{4}$.

■ Since perpendicular lines have slopes that are negative reciprocals:

$$-\frac{k}{7} = -\frac{4}{3}$$

$$k = \frac{28}{3}$$

32. **(405)** Rate of change in depth in feet per second is

$$\frac{195-69}{39-11} = \frac{126}{28} = \frac{9}{2} \text{ feet per second}$$

Since 1.5 minutes is equivalent to 90 seconds, 1.5 minutes after his initial descent the diver will be

$$\frac{9}{2} \frac{\text{feet}}{\text{second}} \times 90 \text{ seconds} = 405 \text{ feet}$$

below sea level.

33. **(3.2)** Since $|-3| = 3$, rewrite the inequality as $9 < 4x - 3 < 10$. Adding 3 to each member of the inequality gives $12 < 4x < 13$. Dividing each member of the inequality by 4 makes $3 < x < \frac{13}{4}$ or, equivalently, $3 < x < 3.25$. Hence, x can be any number between 3 and 3.25, such as 3.2.

34. **(1,215)** Assume that the ratio of the tagged animals drawn to its sample size is approximately the same. If x represents the total number of fish of interest in the lake, then

$$\begin{aligned} \frac{198}{x} &= \frac{22}{135} \\ 22x &= (198)(135) \\ x &= \frac{(198)(135)}{22} \\ &= 1,215 \end{aligned}$$

35. **(47)** The volume of the rectangular container is $10 \times 15 \times 20 = 3,000$ cubic inches. The volume of the cylinder is $\pi r^2 h = \pi(2)^2(5) = 20\pi$. To find the maximum number of full cylindrical cups of water that can be placed into the container with no overflow, divide the volume of the rectangular container by the volume of the cylindrical cup and round the answer down:

$$\frac{3,000}{20\pi} \approx 47.7$$

so, the maximum number of full cups of water without overflowing is 47.

36. **(42)** The area of an equilateral triangle with side s is $\frac{s^2\sqrt{3}}{4}$. Hence,

$$\begin{aligned}\frac{s^2\sqrt{3}}{4} &= \frac{27}{\sqrt{3}} \\ s^2 &= \frac{27 \times 4}{\sqrt{3} \times \sqrt{3}} \\ &= \frac{108}{3} \\ s &= \sqrt{36} = 6\end{aligned}$$

Since the pendant has 7 sides each of which has a length of 6 centimeters, the distance around the pendant is $7 \times 6 = 42$ centimeters.

- 37-38.** It is given that the function $h(t) = -4.9t^2 + 88.2t$ describes the height of a projectile, in meters, after t seconds have elapsed.

37. **(18)** The projectile will hit the ground when $h(t) = 0$:

$$\begin{aligned}-4.9t^2 + 88.2t &= 0 \\ 4.9t(t - 18) &= 0 \Rightarrow t = 18\end{aligned}$$

38. **(397)** To find the maximum height, write the parabola equation in vertex form:

$$\begin{aligned}h(t) &= -4.9t^2 + 88.2t \\ &= -4.9(t^2 - 18t) \\ &= -4.9(t^2 - 18t + 81) + (4.9)(81) \\ &= -4.9(t - 9)^2 + 396.9\end{aligned}$$

The y -coordinate of the vertex, to the nearest meter, is 397.

HOW TO EVALUATE YOUR PERFORMANCE ON A PRACTICE TEST

To estimate where your practice SAT math test scores fall on a 200–800 SAT scale, follow the steps in the Self Scoring Conversion Chart that follows. Keep in mind that the conversion table actually used by the College Board will be different than the one presented here. The College Board develops its conversion table using a large database of student test score data.

Self Scoring Conversion Chart

1. Enter the Number of Correct Answers on the 20 Question No-Calculator Section:

_____ (A)

2. Enter the Number of Correct Answers on the 38 Question Calculator Section:

_____ (B)

3. Raw Score: _____ (A + B)

4. Use the accompanying conversion table to approximate where your SAT scaled score would fall on a 200–800 scale.

Raw Score (A + B)	Scaled Score	Percent Correct
55-58	750-800	95%-100%
50-54	700-740	86%-94%
44-49	650-690	76%-85%
39-43	600-640	67%-75%
32-38	550-590	55%-66%
26-31	500-540	45%-54%
20-25	450-490	34%-44%
15-19	400-440	26%-33%
7-14	300-390	12%-25%
0-6	200-290	0%-11%