Part I

Answer all 30 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the separate answer sheet the numeral preceding the word or expression that best completes the statement or answers the question. [60]

Use this space for computations.

1 Given:

$$X = \{1, 2, 3, 4\}$$
$$Y = \{2, 3, 4, 5\}$$
$$Z = \{3, 4, 5, 6\}$$

What is the intersection of sets X, Y, and Z?
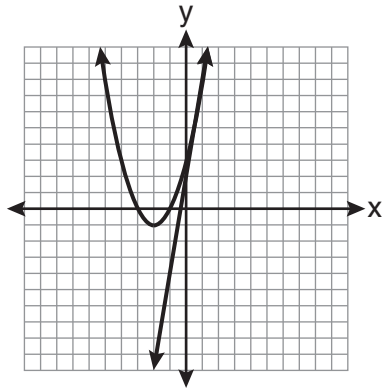
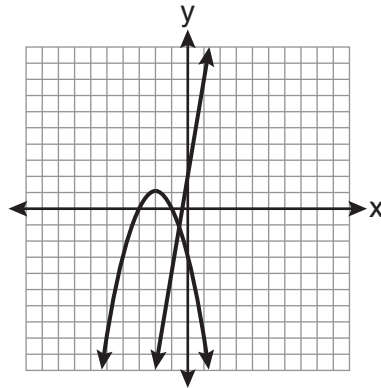(1) $\{3, 4\}$ (3) $\{3, 4, 5\}$

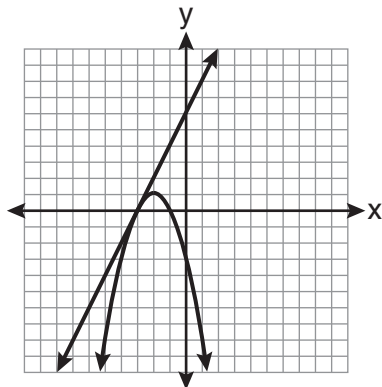(2) $\{2, 3, 4\}$ (4) $\{1, 2, 3, 4, 5, 6\}$

2 Which graph could be used to find the solution of the system of equations $y = 2x + 6$ and $y = x^2 + 4x + 3$?
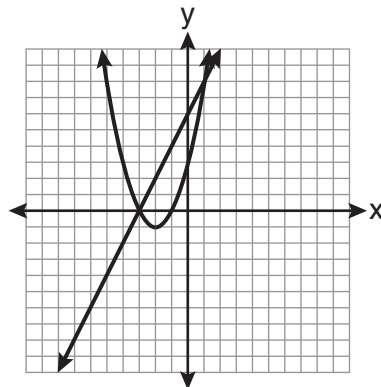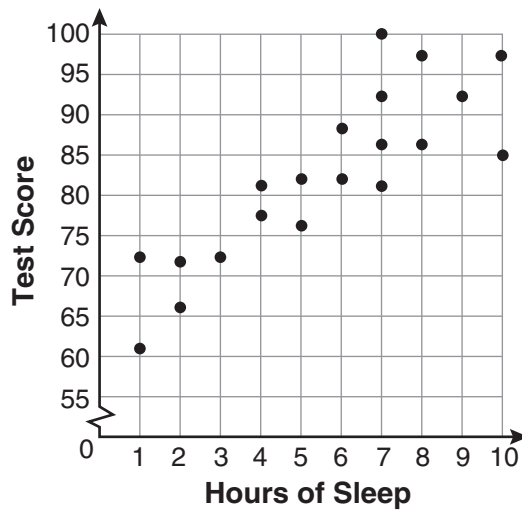

(1)

(3)

(2)

(4)

3 What is the relationship between the independent and dependent variables in the scatter plot shown below?

(1) undefined correlation   (3) positive correlation

(2) negative correlation   (4) no correlation

4 Tim ate four more cookies than Alice. Bob ate twice as many cookies as Tim. If x represents the number of cookies Alice ate, which expression represents the number of cookies Bob ate?

(1) $2 + (x + 4)$ (3) $2(x + 4)$

(2) $2x + 4$ (4) $4(x + 2)$

5 Which relation is a function?

(1) $\{(\frac{3}{4},0), (0,1), (\frac{3}{4},2)\}$ (3) $\{(-1,4), (0,5), (0,4)\}$

(2) $\{(-2,2), (-\frac{1}{2},1), (-2,4)\}$ (4) $\{(2,1), (4,3), (6,5)\}$

6 What is the value of x in the equation $2(x - 4) = 4(2x + 1)$?

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

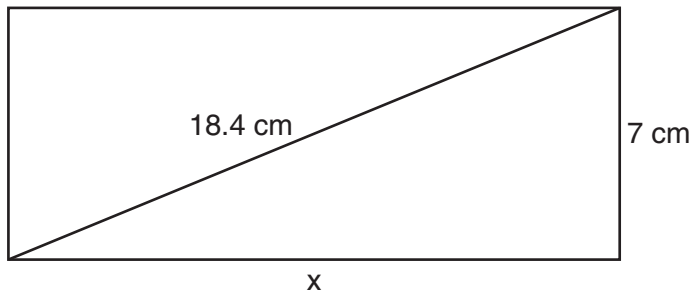(2) 2 (4) $\frac{1}{2}$

7 The rectangle shown below has a diagonal of 18.4 cm and a width of 7 cm.

To the *nearest centimeter*, what is the length, x, of the rectangle?

(1) 11   (3) 20

(2) 17   (4) 25

8 When $a^3 - 4a$ is factored completely, the result is

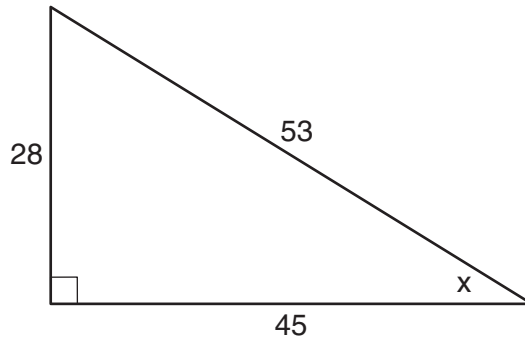(1) $(a - 2)(a + 2)$ (3) $a^2(a - 4)$

(2) $a(a - 2)(a + 2)$ (4) $a(a - 2)^2$

9 Which ratio represents sin x in the right triangle shown below?

(1) $\frac{28}{53}$ (3) $\frac{45}{53}$

(2) $\frac{28}{45}$ (4) $\frac{53}{28}$

10 What is the value of the expression $(a^3 + b^0)^2$ when $a = -2$ and $b = 4$?

(1) 64   (3) -49

(2) 49   (4) -64

11 A student correctly graphed the parabola shown below to solve a given quadratic equation.
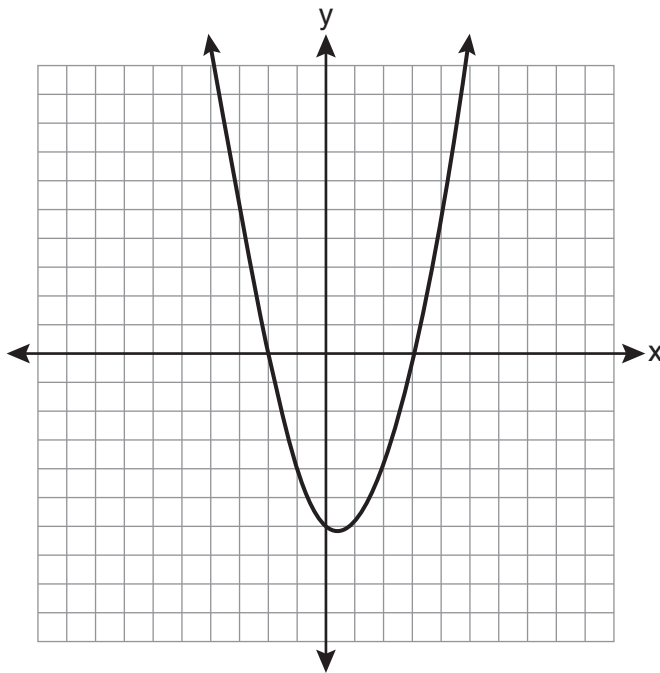
What are the roots of the quadratic equation associated with this graph?

(1) −6 and 3   (3) −3 and 2

(2) −6 and 0   (4) −2 and 3

12 Which value of x is the solution of the equation $\frac{2}{3}x + \frac{1}{2} = \frac{5}{6}$?

(1) $\frac{1}{2}$ (3) $\frac{2}{3}$

(2) 2   (4) $\frac{3}{2}$

13 What is the range of the data represented in the box-and-whisker plot shown below?

(1) 40   (3) 60

(2) 45   (4) 100

14 Which equation illustrates the associative property?
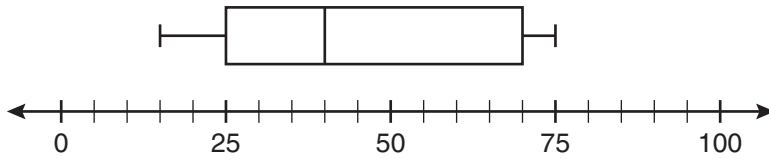
(1) $x + y + z = x + y + z$

(2) $x(y + z) = xy + xz$

(3) $x + y + z = z + y + x$

(4) $(x + y) + z = x + (y + z)$

15 Josh and Mae work at a concession stand. They each earn $8 per hour. Josh worked three hours more than Mae. If Josh and Mae earned a total of $120, how many hours did Josh work?

(1) 6   (3) 12

(2) 9   (4) 15

16 Which data set describes a situation that could be classified as quantitative?

    (1) the phone numbers in a telephone book

    (2) the addresses for students at Hopkins High School

    (3) the zip codes of residents in the city of Buffalo, New York

    (4) the time it takes each of Mr. Harper's students to complete a test

17 Which is the graph of $y = |x| + 2$?

(1)

(3)

(2)

(4)
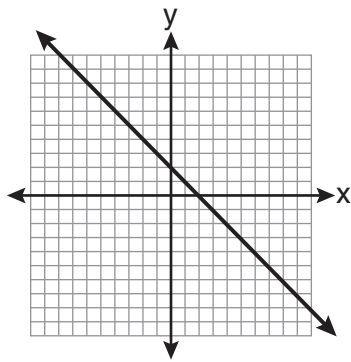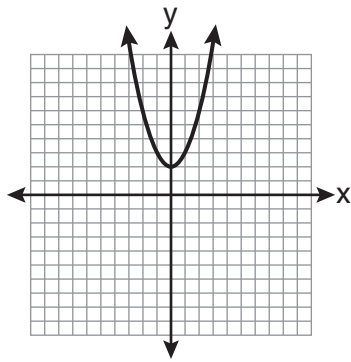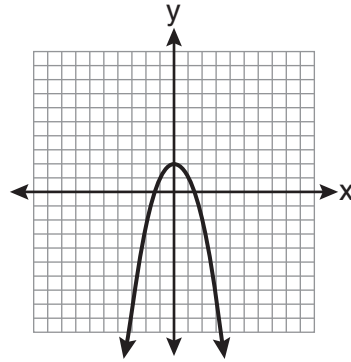
18 Sam's grades on eleven chemistry tests were 90, 85, 76, 63, 94, 89, 81, 76, 78, 69, and 97. Which statement is true about the measures of central tendency?

(1) mean > mode   (3) mode > median

(2) mean < median   (4) median = mean

19 Which interval notation represents the set of all real numbers greater than 2 and less than or equal to 20?
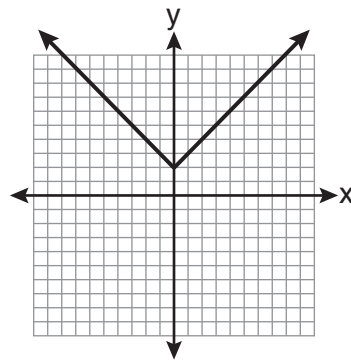
(1) (2,20)   (3) [2,20)

(2) (2,20]   (4) [2,20]

20 What is the sum of $\frac{3}{2x}$ and $\frac{7}{4x}$?

(1) $\frac{21}{8x^2}$ (3) $\frac{10}{6x}$

(2) $\frac{13}{4x}$ (4) $\frac{13}{8x}$

21 What is $3\sqrt{2} + \sqrt{8}$ expressed in simplest radical form?

(1) $3\sqrt{10}$ (3) $5\sqrt{2}$

(2) $3\sqrt{16}$ (4) $7\sqrt{2}$

22 What is the slope of the line whose equation is $3x - 7y = 9$?

(1) $-\frac{3}{7}$ (3) $-\frac{7}{3}$

(2) $\frac{3}{7}$ (4) $\frac{7}{3}$

23 The figure shown below is composed of two rectangles and a quarter circle.
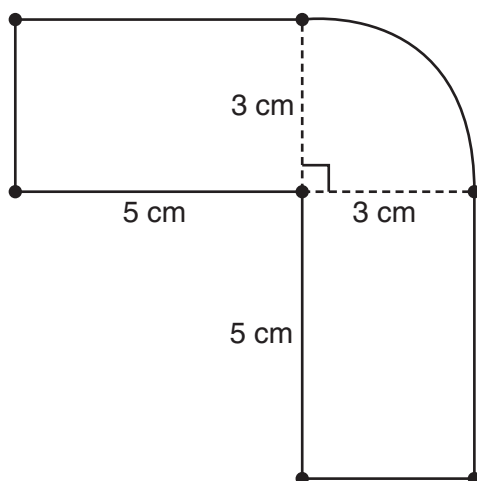
What is the area of this figure, to the *nearest square centimeter*?

(1) 33   (3) 44

(2) 37   (4) 58

24 The expression $\dfrac{(10w^3)^2}{5w}$ is equivalent to

(1) $2w^5$ (3) $20w^5$

(2) $2w^8$ (4) $20w^8$

25 If $\frac{ey}{n} + k = t$, what is y in terms of e, n, k, and t?

(1) $y = \frac{tn + k}{e}$ (3) $y = \frac{n(t + k)}{e}$

(2) $y = \frac{tn - k}{e}$ (4) $y = \frac{n(t - k)}{e}$

26 What is the result when $2x^2 + 3xy - 6$ is subtracted from $x^2 - 7xy + 2$?

(1) $-x^2 - 10xy + 8$ (3) $-x^2 - 4xy - 4$

(2) $x^2 + 10xy - 8$ (4) $x^2 - 4xy - 4$

27 What is an equation of the axis of symmetry of the parabola represented by $y = -x^2 + 6x - 4$?

(1) $x = 3$ (3) $x = 6$

(2) $y = 3$ (4) $y = 6$

28 Which equation has roots of -3 and 5?

(1) $x^2 + 2x - 15 = 0$ (3) $x^2 + 2x + 15 = 0$

(2) $x^2 - 2x - 15 = 0$ (4) $x^2 - 2x + 15 = 0$

29 A spinner that is equally divided into eight numbered sectors is spun 20 times. The table below shows the number of times the arrow landed in each numbered sector.

Spinner Sector	Number of Times
1	2
2	3
3	2
4	3
5	4
6	2
7	3
8	1

Based on the table, what is the empirical probability that the spinner will land on a prime number on the next spin?

(1) $\frac{9}{20}$ (3) $\frac{12}{20}$

(2) $\frac{11}{20}$ (4) $\frac{14}{20}$

30 Which expression represents $\dfrac{x^2 - x - 6}{x^2 - 5x + 6}$ in simplest form?

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

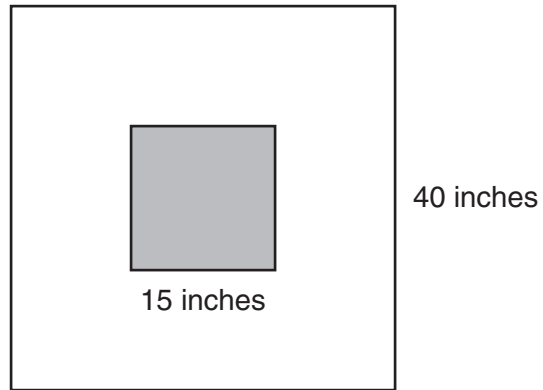(2) $\dfrac{-x - 6}{-5x + 6}$ (4) -1

Part II

Answer all 3 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [6]

31 Roberta needs ribbon for a craft project. The ribbon sells for $3.75 per yard. Find the cost, in dollars, for 48 inches of the ribbon.

32 The square dart board shown below has a side that measures 40 inches. The shaded portion in the center is a square whose side is 15 inches. A dart thrown at the board is equally likely to land on any point on the dartboard.

40 inches

15 inches

Find the probability that a dart hitting the board will *not* land in the shaded area.

33 As shown in the diagram below, a ladder 5 feet long leans against a wall and makes an angle of 65° with the ground. Find, to the *nearest tenth of a foot*, the distance from the wall to the base of the ladder.

5 feet

65°
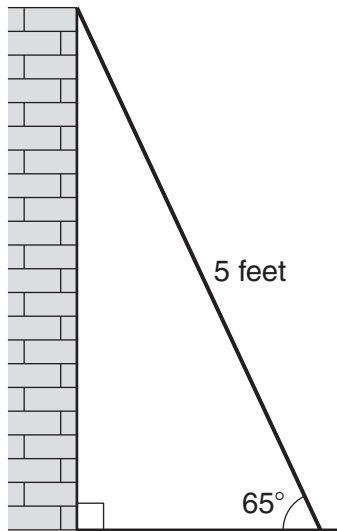
Part III

Answer all 3 questions in this part. Each correct answer will receive 3 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [9]

34 A line having a slope of $\frac{3}{4}$ passes through the point $(-8,4)$.

Write the equation of this line in slope-intercept form.

35 The test scores for 18 students in Ms. Mosher's class are listed below:

86, 81, 79, 71, 58, 87, 52, 71, 87, 87, 93, 64, 94, 81, 76, 98, 94, 68

Complete the frequency table below.

Interval	Tally	Frequency
51–60		
61–70		
71–80		
81–90		
91–100		

Draw and label a frequency histogram on the grid below.

36 Solve algebraically for x: $\dfrac{x+2}{6} = \dfrac{3}{x-1}$

Part IV

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [12]

37 An oil company distributes oil in a metal can shaped like a cylinder that has an actual radius of 5.1 cm and a height of 15.1 cm. A worker incorrectly measured the radius as 5 cm and the height as 15 cm. Determine the relative error in calculating the surface area, to the *nearest thousandth*.

38 The Booster Club raised $30,000 for a sports fund. No more money will be placed into the fund. Each year the fund will decrease by 5%. Determine the amount of money, to the *nearest cent*, that will be left in the sports fund after 4 years.

39 Graph the following system of inequalities on the set of axes shown below and label the solution set S.

$$y > -x + 2$$

$$y \leq \frac{2}{3}x + 5$$
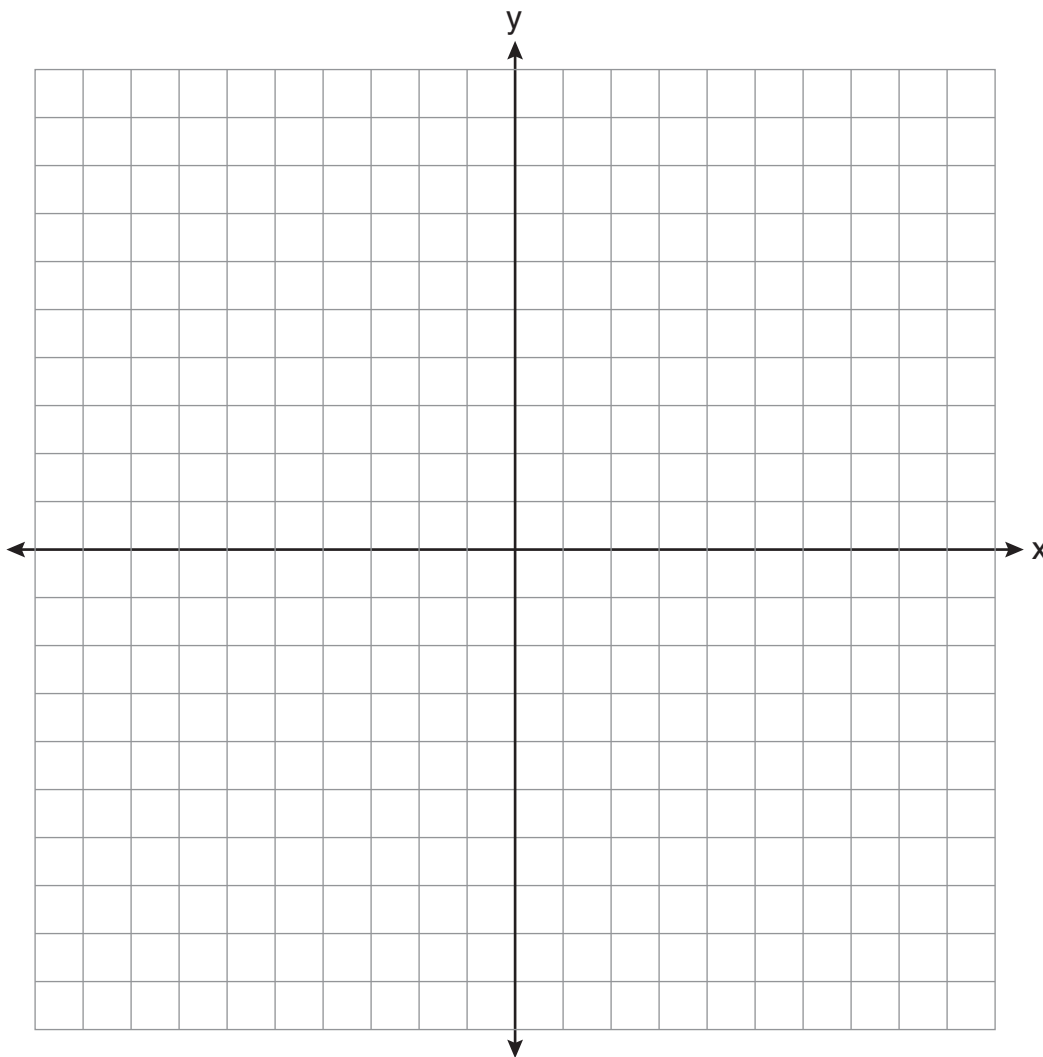
Part I

Allow a total of 60 credits, 2 credits for each of the following. Allow credit if the student has written the correct answer instead of the numeral 1, 2, 3, or 4.

(1) 1	(9) 1	(17) 3	(25) 4
(2) 4	(10) 2	(18) 1	(26) 1
(3) 3	(11) 4	(19) 2	(27) 1
(4) 3	(12) 1	(20) 2	(28) 2
(5) 4	(13) 3	(21) 3	(29) 3
(6) 1	(14) 4	(22) 2	(30) 1
(7) 2	(15) 2	(23) 2	
(8) 2	(16) 4	(24) 3	