Part I

Answer all 30 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Record your answers on your separate answer sheet. [60]

1 The number of hours spent on math homework during one week and the math exam grades for eleven students in Ms. Smith’s algebra class are plotted below.

![Graph of Ms. Smith's Class](image)

Based on the plotted data, what is the correlation between the time spent on homework and the exam grade?

(1) positive  (3) no correlation
(2) negative  (4) cannot be determined

2 A car uses one gallon of gasoline for every 20 miles it travels. If a gallon of gasoline costs $3.98, how much will the gas cost, to the nearest dollar, to travel 180 miles?

(1) 9  (3) 45
(2) 36  (4) 80
3 If Angelina’s weekly allowance is \( d \) dollars, which expression represents her allowance, in dollars, for \( x \) weeks?

(1) \( dx \)  \hspace{1cm}  (3) \( x + 7d \)

(2) \( 7dx \)  \hspace{1cm}  (4) \( \frac{d}{x} \)

4 What is the solution of the system of equations shown in the graph below?

(1) \((1,0)\) and \((-3,0)\)  \hspace{1cm}  (3) \((-1,-2)\)

(2) \((0,-3)\) and \((0,-1)\)  \hspace{1cm}  (4) \((-2,-1)\)

5 The solution of the equation \( 5 - 2x = -4x - 7 \) is

(1) \( 1 \)  \hspace{1cm}  (3) \(-2\)

(2) \( 2 \)  \hspace{1cm}  (4) \(-6\)
6 The expression $100n^2 - 1$ is equivalent to

(1) $(10n + 1)(10n - 1)$  
(2) $(10n - 1)(10n - 1)$  
(3) $(50n + 1)(50n - 1)$  
(4) $(50n - 1)(50n - 1)$

7 In right triangle $ABC$ shown below, what is the value of $\cos A$?

8 A bag contains five green gumdrops and six red gumdrops. If Kim pulls a green gumdrop out of the bag and eats it, what is the probability that the next gumdrop she pulls out will be red?

(1) $\frac{5}{11}$  
(2) $\frac{5}{10}$  
(3) $\frac{6}{11}$  
(4) $\frac{6}{10}$
9 Which graph represents a function?

![Graphs](image)

10 The current population of a town is 10,000. If the population, \( P \), increases by 20% each year, which equation could be used to find the population after \( t \) years?

(1) \( P = 10,000(0.2)^t \)  
(2) \( P = 10,000(0.8)^t \)  
(3) \( P = 10,000(1.2)^t \)  
(4) \( P = 10,000(1.8)^t \)
11 Which verbal expression is represented by $2(x + 4)$?

(1) twice the sum of a number and four
(2) the sum of two times a number and four
(3) two times the difference of a number and four
(4) twice the product of a number and four

12 How many cubes with 5-inch sides will completely fill a cube that is 10 inches on a side?

(1) 50 (3) 8
(2) 25 (4) 4

13 A school newspaper will survey students about the quality of the school's lunch program. Which method will create the least biased results?

(1) Twenty-five vegetarians are randomly surveyed.
(2) Twenty-five students are randomly chosen from each grade level.
(3) Students who dislike the school's lunch program are chosen to complete the survey.
(4) A booth is set up in the cafeteria for the students to voluntarily complete the survey.

14 The vertex of the parabola $y = x^2 + 8x + 10$ lies in Quadrant

(1) I (3) III
(2) II (4) IV
15 In the figure below, $ABCD$ is a square and semicircle $O$ has a radius of 6.

What is the area of the figure?

- (1) $36 + 6\pi$
- (2) $36 + 18\pi$
- (3) $144 + 18\pi$
- (4) $144 + 36\pi$

16 What is $24x^2y^6 - 16x^6y^2 + 4xy^2$ divided by $4xy^2$?

- (1) $6xy^4 - 4x^5$
- (2) $6xy^4 - 4x^5 + 1$
- (3) $6x^2y^3 - 4x^6y$
- (4) $6x^2y^3 - 4x^6y + 1$

17 Which expression can be used to change 75 kilometers per hour to meters per minute?

- (1) $\frac{75 \text{ km}}{1 \text{ hr}} \times \frac{1 \text{ km}}{1,000 \text{ m}} \times \frac{1 \text{ hr}}{60 \text{ min}}$
- (2) $\frac{75 \text{ km}}{1 \text{ hr}} \times \frac{1 \text{ km}}{1,000 \text{ m}} \times \frac{60 \text{ min}}{1 \text{ hr}}$
- (3) $\frac{75 \text{ km}}{1 \text{ hr}} \times \frac{1,000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{60 \text{ min}}$
- (4) $\frac{75 \text{ km}}{1 \text{ hr}} \times \frac{1,000 \text{ m}}{1 \text{ km}} \times \frac{60 \text{ min}}{1 \text{ hr}}$
18 The inequality $-2 \leq x \leq 3$ can be written as

(1) $(-2, 3)$  
(2) $[-2, 3]$  
(3) $(-2, 3]$  
(4) $[-2, 3]$  

19 The expression $\frac{6 \times 10^{-7}}{3 \times 10^{-3}}$ is equivalent to

(1) $2 \times 10^4$  
(2) $2 \times 10^{10}$  
(3) $2 \times 10^{-4}$  
(4) $2 \times 10^{-10}$  

20 The roots of the equation $x^2 - 14x + 48 = 0$ are

(1) $-6$ and $-8$  
(2) $-6$ and $8$  
(3) $6$ and $-8$  
(4) $6$ and $8$  

21 If $x = -3$, what is the value of $|x - 4| - x^2$?

(1) $-8$  
(2) $-2$  
(3) $7$  
(4) $16$  

22 Which equation represents a line parallel to the line whose equation is $2x - 3y = 9$?

(1) $y = \frac{2}{3}x - 4$  
(2) $y = -\frac{2}{3}x + 4$  
(3) $y = \frac{3}{2}x - 4$  
(4) $y = -\frac{3}{2}x + 4$
23 Which ordered pair is in the solution set of the system of inequalities 
\[ y \leq 3x + 1 \text{ and } x - y > 1 \]?

(1) \((-1, -2)\) \hspace{1cm} (3) \((1, 2)\)
(2) \((2, -1)\) \hspace{1cm} (4) \((-1, 2)\)

24 Which equation represents the line that passes through the point 
\((-3, 4)\) and is parallel to the x-axis?

(1) \(x = 4\) \hspace{1cm} (3) \(y = 4\)
(2) \(x = -3\) \hspace{1cm} (4) \(y = -3\)

25 A cube with faces numbered 1 through 6 is rolled 75 times, and the 
results are given in the table below.

<table>
<thead>
<tr>
<th>Number</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Based on these results, which statement is true?

(1) \(P(\text{odd}) < P(\text{even})\) \hspace{1cm} (3) \(P(\text{even}) < P(2 \text{ or } 4)\)
(2) \(P(3 \text{ or less}) < P(\text{odd})\) \hspace{1cm} (4) \(P(2 \text{ or } 4) < P(3 \text{ or less})\)

26 Given:

\[
A = \{\text{perfect square integers from 4 to 100, inclusive}\}
\]
\[
B = \{16, 36, 49, 64\}
\]

The complement of set \(B\) in the universal set \(A\) is

(1) \(\{9, 25, 81\}\) \hspace{1cm} (3) \(\{1, 4, 9, 25, 81, 100\}\)
(2) \(\{4, 9, 25, 81, 100\}\) \hspace{1cm} (4) \(\{4, 16, 36, 49, 64, 100\}\)
27 The expression \( \frac{2x^2 + 10x - 28}{4x + 28} \) is equivalent to

(1) \( \frac{x - \frac{2}{2}}{} \)
(2) \( x - 1 \)
(3) \( \frac{x + \frac{2}{2}}{} \)
(4) \( \frac{x + \frac{5}{2}}{} \)

28 Which value of \( x \) is the solution of the equation \( \frac{1}{7} + \frac{2x}{3} = \frac{15x - 3}{21} \)?

(1) 6
(2) 0
(3) \( \frac{4}{13} \)
(4) \( \frac{6}{29} \)

29 Which statement is true about the data set 4, 5, 6, 6, 7, 9, 12?

(1) mean = mode
(2) mode = median
(3) mean < median
(4) mode > mean

30 How is the graph of \( y = x^2 + 4x + 3 \) affected when the coefficient of \( x^2 \) is changed to a smaller positive number?

(1) The graph becomes wider, and the \( y \)-intercept changes.
(2) The graph becomes wider, and the \( y \)-intercept stays the same.
(3) The graph becomes narrower, and the \( y \)-intercept changes.
(4) The graph becomes narrower, and the \( y \)-intercept stays the same.

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Use this space for computations.
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. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

31. Express $4\sqrt{75}$ in simplest radical form.
32 Factor completely: $5x^3 - 20x^2 - 60x$
33 On the set of axes below, graph $y = 2|x + 3|$. Include the interval $-7 \leq x \leq 1$. 
In a game, a player must spin each spinner shown in the diagram below once.

Draw a tree diagram or list a sample space showing all possible outcomes.

Determine the number of outcomes that consist of a prime number and a letter in the word “CAT.”
35 The cost of three notebooks and four pencils is $8.50. The cost of five notebooks and eight pencils is $14.50. Determine the cost of one notebook and the cost of one pencil.

[Only an algebraic solution can receive full credit.]
Wendy measures the floor in her rectangular bedroom for new carpeting. Her measurements are 24 feet by 14 feet. The actual measurements are 24.2 feet by 14.1 feet.

Determine the relative error in calculating the area of her bedroom. Express your answer as a decimal to the nearest thousandth.
37 Using the line provided, construct a box-and-whisker plot for the 12 scores below.

26, 32, 19, 65, 57, 16, 28, 42, 40, 21, 38, 10

Determine the number of scores that lie above the 75th percentile.
38 A metal pipe is used to hold up a 9-foot fence, as shown in the diagram below. The pipe makes an angle of $48^\circ$ with the ground.

Determine, to the nearest foot, how far the bottom of the pipe is from the base of the fence.

Determine, to the nearest foot, the length of the metal pipe.
39 On the set of axes below, graph the following system of equations.

\[ y + 2x = x^2 + 4 \]
\[ y - x = 4 \]

Using the graph, determine and state the coordinates of all points in the solution set for the system of equations.
Scrap Graph Paper — This sheet will *not* be scored.
### Reference Sheet

#### Trigonometric Ratios

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sin A$</td>
<td>$\frac{\text{opposite}}{\text{hypotenuse}}$</td>
</tr>
<tr>
<td>$\cos A$</td>
<td>$\frac{\text{adjacent}}{\text{hypotenuse}}$</td>
</tr>
<tr>
<td>$\tan A$</td>
<td>$\frac{\text{opposite}}{\text{adjacent}}$</td>
</tr>
</tbody>
</table>

#### Area

- **Trapezoid**
  
  $A = \frac{1}{2}h(b_1 + b_2)$

#### Volume

- **Cylinder**
  
  $V = \pi r^2 h$

#### Surface Area

- **Rectangular Prism**
  
  $SA = 2lw + 2hw + 2lh$

- **Cylinder**
  
  $SA = 2\pi r^2 + 2\pi rh$

#### Coordinate Geometry

$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$