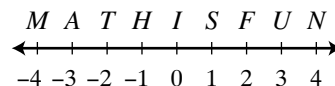


Section A. Each correct answer is worth 1 point.

1. List all prime factors of 12.

2. (a) Find the name (capital letter) of the midpoint of \overline{AS} .

(b) If F is the midpoint of \overline{AX} , give the coordinate of point X .



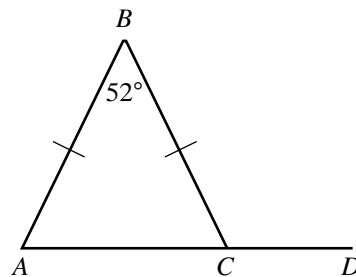
3. Along with the traditional Pi (Π) Day on March 14, some mathematicians like to have a second celebration, called "Fall Π Day." If Fall Π Day is considered to be the 314th day of the year, what is the date for Fall Π Day this year (2007)?

4. Express $\frac{2007}{7002}$ as a fraction in simplest form.

5. Solve for all real values of x : $x^2 = 4x$.

6. Express as a decimal: $5^{-2} + 10^{-1}$.

7. Given the figure as shown, find $m\angle BCD$.



Section B. Each correct answer is worth 2 points.

8. For the seven numbers $\{ x, 17, x + 4, 4x - 3, -16, 9, x - 4 \}$, the mean is 4. What is the median of these seven numbers?

9. Simplify: $\frac{a^3 - b^3}{a^2 - b^2}$.

10. Given that $4^{20} + 4^{20} = 2^x$, find x .

11. Evaluate: $\left(\begin{vmatrix} 10 & 7 \\ 6 & 5 \end{vmatrix} \right)^2 - \sum_{k=1}^4 k$. (Note: $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$ is the determinant of that matrix.)

12. Find the center and the radius of the circle $3x^2 + 3y^2 - 24y + 18x = 25$.

Section C. Each correct answer is worth 3 points.

13. Solve the system on the right and express your answer as an ordered pair (x, y) . Note that k is a constant real number.

$$\begin{cases} 3x + ky = 6 \\ 2x - 3y = 6 \end{cases}$$

14. Solve for all values of α ($0^\circ \leq \alpha \leq 180^\circ$) such that $\sin^2 \alpha - \cos \alpha - \cos^2 \alpha = 1$.

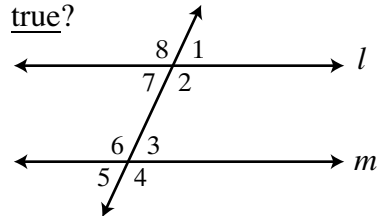
15. In the expansion of $(a + b)^n$, there are $n + 1$ individual terms. Find the number of individual terms in the expansion of $(a + b + c)^{10}$.

Section A. Each correct answer is worth 1 point.

- Which of these numbers has the largest prime factor? 39, 40, 51, 77, 91, 108, 121
- Find the product of the squares of the first five natural numbers.
- The sum of eleven consecutive odd numbers is 2277. Find the largest of these eleven numbers.
- Given that $\tan \theta = \frac{3}{5}$, with the terminal side of θ in Quadrant III, find the exact value of $\sin \theta$.

5. In the figure, lines l and m are parallel. Which statements are true?

- I. $\angle 1 \cong \angle 5$ II. $\angle 8 \cong \angle 6$ III. $\angle 4 \cong \angle 7$
 A) I only B) II only C) III only
 D) I and II only E) I, II, and III



- Solve for all integral values of x : $-4 \leq |x| < 2$.
- Give an example of a rectangle whose perimeter (in inches) has the same numerical value as its area (in square inches).

Section B. Each problem is worth 2 points.

- In the sequence $\dots, a, b, c, d, e, 0, 1, 1, 2, 3, 5, 8, \dots$, each term is the sum of the two terms immediately to its left. Find a .
- If Δ represents an operation defined as $m \Delta n = m^n - m$, find $2 \Delta (3 \Delta 2)$.
- Given $f(x) = x^3 + x^2 - 4x - 4$, find the sum of all the intercepts when $f(x)$ is graphed on the x - y coordinate system.
- Note that on this part of the contest, there are 2 ways to score 2 points (either get 2 correct from Section A, or 1 correct from Section B). Similarly, there are 3 ways to score 3 points ($1 + 1 + 1$, or $1 + 2$, or 3), and 4 ways to score 4 points ($1 + 1 + 1 + 1$, or $1 + 1 + 2$, or $1 + 3$, or $2 + 2$). How many different ways can you score 11 points on this part? (It is not 11.)
- Sarah drove 30 miles from home to the Bluffton University Mathematics Contest in 50 minutes. How fast (in mph) must she drive home in order to average 40 mph for the entire trip?

Section C. Each problem is worth 3 points.

- A set of N numbers has sum S . Each number in the set is increased by 20, then multiplied by 4, then decreased by 20. Find the sum of the numbers in the new set (in terms of N and S).
- The vertices of $\triangle ABC$ are $A(0, 0)$, $B(5, -2)$, and $C(1, -4)$. Find the measure of the smallest angle, rounded to the nearest degree.
- A single die (number cube) is tossed 3 times. What is the probability that exactly 2 of the numbers will be the same?