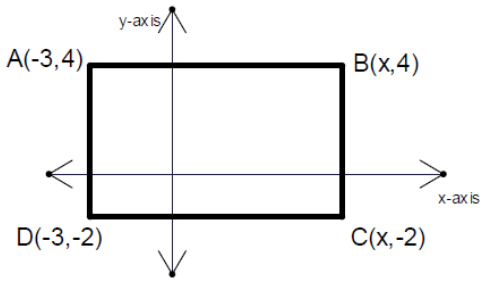
Competition A – Algebra 1 – Individual Contest

Team Make-up: maximum 6 students; freshmen or students enrolled in Algebra I
Questions: 20
Time: 50 minutes
Format: Individual competition
All battery operated calculators permitted, including CAS-type
Answers must be legible
Answers must be **exact** unless otherwise indicated in the question
Scoring: Correct answers worth 2 points each; 40 points possible per team member
Team Score: The top 4 scores count toward the team score; 5th and 6th scores are used for tie-breaking
Maximum 160 points per team

Sample Regional Questions

1. $\left(4m^3+3m^2-m\right)+\left(m^2+4m-2\right)=km^3+wm^2+pm+q$. Determine the sum $\left(k+w+p+q\right)$.
Answer: 9

2. The perimeter of the quadrilateral $ABCD$ can be written as the expression $kx+w$. Determine the ordered pair $\left(k,w\right)$.



Answer: (2, 18)

3. Determine the sum of the smallest and largest solutions for the inequality $\left|2x-5\right|\le 11$.

Answer: 5

4. Let $\left(x+3y\right)^2=10$. Determine the numerical value of $\left(6x^2+36xy+54y^2\right)$.

Answer: 60

5. If $\begin{bmatrix}3 & 2\\ d & 4\end{bmatrix}+2\begin{bmatrix}4 & 3\\ e & 5\end{bmatrix}=\begin{bmatrix}a & b\\ 4 & c\end{bmatrix}$, find the value of the expression $\left(a+b+c+2d+4e\right)$.
Answer: 41

6. A first line has the equation $4x+3y=20$ and a second line has the equation $2x-3y=12$. A third line has the same x-intercept as the first line and a y-intercept that is $\frac{1}{2}$ the y-intercept of the second line. Find the slope of the third line. Give your answer as a common or improper fraction reduced to lowest terms.

Answer: $\frac{2}{5}$

7. Working at a constant rate, Bob would need 30 hours to build a certain brick wall. Working at a constant rate, Kay would need 21 hours to build the same wall. Due to magical chemistry, if they work together, a total of 8 more bricks will be laid per hour than if working alone. By working together, they took exactly 11 hours, and 40 minutes to build the wall. Find the number of bricks that the wall contained.

Answer: 1680

8. For all valid replacements of x and y, $x \oplus y = \dfrac{x^2 - 2y}{y}$. Determine the value of $2 \oplus \left[(-4) \oplus 9\right]$.

Answer: –20

9. Find the value of x that satisfies $\dfrac{x-3}{x-7} = \dfrac{x+4}{x+7}$.

Answer: –1

10. Two of the solutions for x in the equation $x^3 - 9x = 5x^2 - 45$ are selected at random. These two values are the solutions for y in the equation $ay^2 + by + c = 0$ where a, b, and c are integers with no common factors and $a > 0$. Determine the probability that $b < 0$. Express your answer as a common fraction.

Answer: $\dfrac{2}{3}$