1. What is one-half of $1 \times 10^{24}$?
   a) $5.0 \times 10^{11}$  b) $1.0 \times 10^{12}$  c) $5.0 \times 10^{23}$  d) $5.0 \times 10^{24}$  e) $1.0 \times 10^{11}$.

2. For how many different values of $a$ does $\sqrt{a + 16} = \sqrt{a} + 4$
   a) 0  b) 1  c) 2  d) 3  e) infinitely many

3. If $x^3y^2 = 32$ and $x^2y^3 = 243$ determine $xy$
   a) $\sqrt[3]{1024}$  b) $\sqrt[3]{3125}$  c) 6  d) 5.5  e) $\sqrt[4]{16800}$

4. If $x$ and $y$ are positive integers such that $x^2 - 2xy - 3y^2 = 21$ then the largest possible value for $x$ is in the range
   a) $x < 10$  b) $10 \leq x < 20$  c) $20 \leq x < 30$  d) $30 \leq x < 40$  e) $40 \leq x$

5. In the sequence of terms $a_1, a_2, a_3, a_4, a_5, \ldots$ we have $a_k = 2a_{k-1} - a_{k-2}$ for $k > 2$. If $a_1 = 5$ and $a_2 = 11$ determine $a_{100}$
   a) 401  b) 499  c) 594  d) 599  e) 605

6. The point $P(a, b)$ on the line $2x + 5y - 35 = 0$ is the same distance from each of the points $(7, -4)$ and $(-4, 7)$. The value of $a + b$ is
   a) 3  b) 7  c) 10  d) 13  e) 17.5

7. How many 6 digit numbers are there whose digits sum to 51?
   a) 3  b) 6  c) 20  d) 36  e) 56

8. In a cube of edge length 4 the centers of the 6 faces form an octahedron. What is the sum of the lengths of the edges of the octahedron?
   a) 24  b) $48\sqrt{2}$  c) $24\sqrt{3}$  d) $24\sqrt{2}$  e) 48

9. A circle of radius 2 cm rolls along the inside of an equilateral triangle of perimeter 36 cm. Determine, to the nearest cm, the perimeter of the triangle traced out by the center of the circle.
   a) 12cm  b) 13cm  c) 14cm  d) 15cm  e) 16cm

10. A rectangular table $PQRS$, has length $PQ$ 7 units and width $QR$ 4 units. A ball is rolled from point $P$ at 45 degrees to $PQ$ and bounces off $SR$. The ball continues to bounce off sides at 45 degrees until it reaches one of the corners $P$, $Q$, $R$, or $S$. How far will the ball travel?
    a) $11\sqrt{2}$  b) $10\sqrt{2}$  c) $56\sqrt{2}$  d) $27\sqrt{2}$  e) $28\sqrt{2}$