Fall 2012 McNabb GDCTM Contest
Algebra One

NO Calculators Allowed

1. On Black Friday a store reduced its price on a camera by 30%. Two weeks later, the item still not having sold, the store reduced the Black Friday sale price by 50%. The final price on the camera is what per cent of its original price?

   (A) 20 **(B)** 35 **(C)** 50 **(D)** 65 **(E)** 80

2. If one defines
   $$(a, b) \wedge (c, d) = ad - bc$$
   solve this equation for x: $(2, x) \wedge (7, -4) = 3$

   (A) $-\frac{7}{11}$ **(B)** $\frac{11}{7}$ **(C)** $\frac{7}{11}$ **(D)** 11 **(E)** $-\frac{11}{7}$

3. In the sequence of numbers
   $$a, b, 1, -1, 0, -1, -1, -2, \cdots$$
   each number after the second is the sum of the previous two numbers. Find the value of a.

   (A) -1 **(B)** 3 **(C)** 0 **(D)** 4 **(E)** 1

4. A certain triangle in the coordinate plane has area 6. Then the x coordinates of each vertex of this triangle are doubled, but the y coordinates of each vertex are left alone. What is the area of this new triangle?

   (A) 3 **(B)** 6 **(C)** 12 **(D)** 24 **(E)** cannot be determined

5. If $\frac{a}{b} = \frac{17}{4}$, $\frac{b}{c} = \frac{3}{7}$, $\frac{c}{d} = \frac{8}{17}$, and $\frac{d}{e} = \frac{7}{6}$, what is the value of $\frac{a}{e}$?

   (A) 1/34 **(B)** 1/2 **(C)** 1 **(D)** 2 **(E)** 14

6. In how many ways can the letters in CHEETAH be arranged so that no two consecutive letters are the same?

   (A) 660 **(B)** 540 **(C)** 1260 **(D)** 720 **(E)** 330

7. The points x, x^2, and x^3 are graphed on the number line below. Which could be the value of x?

(A) -2 **(B)** -1 **(C)** -1/2 **(D)** 1/3 **(E)** 2

8. What is the smallest positive integer n that satisfies $17n - 31m = 1$ if m must also be a positive integer?

(A) 44 **(B)** 17 **(C)** 15 **(D)** 13 **(E)** 11

9. In how many ways can 9 students be divided into 3 groups of 3 students each?

(A) 81 **(B)** 180 **(C)** 280 **(D)** 540 **(E)** 1680

10. How many solutions does the equation $|x - 2| = |4 - x|$ have?

(A) 0 **(B)** 1 **(C)** 2 **(D)** 4 **(E)** infinitely many

11. Which of the integers below can be expressed in the form $p^2 + q^2 + r^2 + s^2 + t^2$ where p, q, r, s and t are all odd integers?

(A) 2012 **(B)** 2013 **(C)** 2014 **(D)** 2015 **(E)** 2016

12. Sixty points are equally spaced entirely around a circle. How many regular polygons can be formed using these and only these points as vertices?

(A) 60 **(B)** 68 **(C)** 78 **(D)** 88 **(E)** 89

13. Cheryl and Matthew take turns removing chips from a pile of 101 chips. On each turn they must remove 1, 2, 3, 4, or 5 chips (which of these number of chips is up to them and can change or not from turn to turn). The winner is the person who removes the last chip or chips. If Cheryl goes first, how many chips should she remove to guarantee that she will win with best play, no matter how Matthew moves?

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

14. A problem from the *Liber Abaci*, a math text written by Fibonnaci in the 13th century:

> On a certain ground there are two towers, one of which is 30 feet high, the other 40, and they are only 50 feet apart; two birds descending together from the heights of the two towers fly to the center of a fountain between the towers; the distance from the center [of the fountain] to the foot of the higher tower is sought.

In this problem assume: the birds are flying at the same speed, depart at the same time, and arrive together at the fountain; and the fountain and feet of the towers are collinear.

(A) 18 **(B)** 20 **(C)** 22 **(D)** 24 **(E)** 32

15. A boat goes downriver from A to B in 3 days and returns upriver from B to A in 4 days. How long in days would it take an inner tube to float downriver from A to B?

(A) 12 **(B)** 18 **(C)** 24 **(D)** 30 **(E)** 32

16. Find the value of x if

$$\begin{aligned} 3x + 2y - z &= 1 \\ -x + y - 3z &= 7 \\ x + 2y + 9z &= -1 \end{aligned}$$

(A) -2 **(B)** -1 **(C)** 0 **(D)** 1 **(E)** 2

17. A frog is on a number line and can jump either one unit to the left or one unit to the right. If it starts at the origin and jumps randomly 6 times, what is the probability it is back at the origin at the end of those 6 jumps?

(A) $\frac{1}{64}$ **(B)** $\frac{1}{4}$ **(C)** $\frac{1}{2}$ **(D)** $\frac{17}{32}$ **(E)** $\frac{5}{16}$

18. The coefficient of x^{18} in the product

$$(x+1)(x+3)(x+5)(x+7)\cdots(x+37)$$

is equal to

(A) 1 **(B)** 243 **(C)** 361 **(D)** 400 **(E)** 401