

# MATHCOUNTS®



## 11<sup>TH</sup> ANNUAL MATHLETES IN ACTION NOVEMBER 8, 2014

### TARGET ROUND PROBLEMS 1 AND 2

NAME \_\_\_\_\_

SCHOOL \_\_\_\_\_

**DO NOT BEGIN UNTIL INSTRUCTED TO DO SO.**

This round of the competition consists of eight problems, which will be presented in pairs. Work on one pair of problems will be completed and answers will be collected before the next pair is distributed. The time limit for each pair of problems is six minutes. The first pair of problems is on the other side of this sheet. When told to do so, turn the page over and begin working. Record your final answer in the designated space on the problem sheet. All answers must be complete, legible and simplified to lowest terms. This round assumes the use of calculators, and calculations may also be done on scratch paper, but no other aids are allowed.

TOTAL CORRECT	SCORER'S INITIALS

# MATHCOUNTS®



## 11<sup>TH</sup> ANNUAL MATHLETES IN ACTION NOVEMBER 8, 2014

### TARGET ROUND PROBLEMS 3 AND 4

NAME \_\_\_\_\_

SCHOOL \_\_\_\_\_

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### TARGET ROUND PROBLEMS 5 AND 6

NAME \_\_\_\_\_

SCHOOL \_\_\_\_\_

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TOTAL CORRECT	SCORER'S INITIALS

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## 11<sup>TH</sup> ANNUAL MATHLETES IN ACTION NOVEMBER 8, 2014

### TARGET ROUND PROBLEMS 7 AND 8

NAME \_\_\_\_\_

SCHOOL \_\_\_\_\_

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This round of the competition consists of eight problems, which will be presented in pairs. Work on one pair of problems will be completed and answers will be collected before the next pair is distributed. The time limit for each pair of problems is six minutes. The last pair of problems is on the other side of this sheet. When told to do so, turn the page over and begin working. Record your final answer in the designated space on the problem sheet. All answers must be complete, legible and simplified to lowest terms. This round assumes the use of calculators, and calculations may also be done on scratch paper, but no other aids are allowed.

TOTAL CORRECT	SCORER'S INITIALS

1. If  $f(x) = (4x-2)/(x+1)$ , what is the value of  $f(3) + f(0) + f(-3)$ ? Express your answer as a common fraction

$$f(3) = (4(3) - 2) \div (3 + 1) = \frac{10}{4} = 2\frac{1}{2}$$

$$f(0) = (4(0) - 2) \div (0 + 1) = -2$$

$$f(-3) = (4(-3) - 2) \div (-3 + 1) = \frac{-14}{-2} = +7$$

$$\frac{15}{2}$$

~~$$+7\frac{1}{2}$$~~

2. Logan drives a delivery truck for water cooler supply company. He drives 560 miles at 70 miles per hour, and gets paid \$12/hour. The truck averages 20 miles per gallon. Gasoline for the truck costs \$3/gallon and truck maintenance is \$0.15 per mile. What is the total cost of the trip for the water cooler supply company?

2. \$

$$\rightarrow 8 \text{ hours} \times \$12/\text{hr} = \$96 \text{ wages}$$

$$28 \text{ gal} \times \$3 = \$84 \text{ gas}$$

$$20 \overline{) 560}$$

$$560 \times 0.15 = \$84$$

\$96

84

84

\$264

3. One cube has a volume of 372 cubic centimeters. The edge length of a second cube is three times the edge length of this first cube. What is the positive difference between the volume of the second cube and the volume of the first cube, in cubic centimeters?

3. 9672 cubic cm

$$372 \times 3 \times 3 \times 3 = 10044$$

$$\begin{array}{r} 10044 \\ - 372 \\ \hline \end{array}$$

$$V_0 = s^3$$

$$\sqrt[3]{372} = s$$

$(372)^{(1/3)} \approx 7.19 \text{ cm}$  (edge length)  
 1st cube  
 $\times 3$  2nd cube  
 $\approx (21.575 \dots)^3 = 10044$   
 $\begin{array}{r} 10044 \\ - 372 \\ \hline 9672 \end{array}$

4. Given points P(-2,7) and Q(4,y), for what value of y is the slope of the line through P and Q equal to  $-\frac{3}{2}$ ?

4. -2

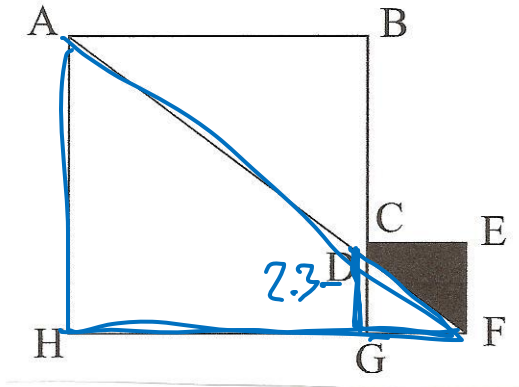
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y - 7}{4 - (-2)} = \frac{-3}{2}$$

$$\frac{y - 7}{6} = \frac{-3 \times 3}{2 \times 3}$$

$$\begin{array}{r} y - 7 = -9 \\ +7 = +7 \\ \hline y = -2 \end{array}$$

$$\begin{array}{r} 2(y - 7) = -3(6) \\ 2y - 14 = -18 \\ 2y + 14 = -4 \\ \hline 2y = -4 \\ y = -2 \end{array}$$

5. In the figure below, a 3-inch by 3-inch square adjoins a 10-inch by 10-inch square. What is the area of the shaded region? Express your answer in square inches as a common fraction.



5.  $\frac{72}{13}$  sq. in

Handwritten work for problem 5:

$$\frac{3}{13} \times 10 = \frac{30}{13}$$

$$\frac{13x}{13} = \frac{30}{13}$$

$$x = 2.3$$

$$\frac{1}{2}bh = \frac{1}{2} \cdot 3 \cdot 3 = 4.5$$

$$\frac{72}{13} - \frac{45}{13} = \frac{27}{13}$$

6. Marco will celebrate his Nth birthday in the year  $N^2$ , which is in the 21<sup>st</sup> century. What year did he celebrate his 13<sup>th</sup> birthday?

6.  $\frac{72}{13}$

Handwritten work for problem 6:

$$2000 \rightarrow 2099$$

$$44^2 = 1936$$

$$45^2 = 2025$$

$$46^2 = 2116$$

$$\begin{array}{r} 2025 \\ - 45 \\ \hline 1980 \end{array} + 13 = 1993$$

7. There are 358 students in Jack's school. Each student's first and last initials form a unique ordered letter pair. How many more students are required to guarantee that there are two students whose initials form the same ordered letter pair?

$$\begin{array}{r} 26 \cdot 26 = 676 \\ \hline \phantom{26 \cdot 26} - 358 \\ \hline 318 \end{array} + 1 = 319$$

7. 319 students

(A, A) (B, A)  
 (A, B) (B, B)  
 (A, C) (B, B)

8. In one roll of four standard six-sided dice, what is the probability of rolling exactly three different numbers? Express answer as common fraction.

$$\frac{1 \cancel{2} \cdot 5 \cdot 4 \cancel{2} \cdot 3 \cancel{1}}{3 \cancel{6} \cdot 6 \cdot \cancel{6} \cdot \cancel{2} \cdot 2 \cancel{1}} = \frac{5}{18}$$

8. \_\_\_\_\_