# Middle School Mathematics Contest – 2017 Solution Key

(Students may have alternate strategies for finding the solutions.)

## Non-Calculator Section Answers

**(1) 12th** floor; $14 + 6 + \text{-}4 + 8 + \text{-}5 + 2 + \text{-}9 = 12$

**(2) 3 ¾ servings**;  $1\,½ \div 2/5 = 3/2 \times 5/2 = 15/4 = 3\,¾$ servings

**(3) IQR = 18;** first, arrange the scores in order:

49, 52, 53, 54, 55, 61, 63, 64, 65, 66, 70, 71, 74, 78, 81, 84; for the median, there are two scores

in the middle, 64 and 65 so 64.5 is the median; the middle of the lower half has two scores in

the middle, 54 and 55 so 54.5 is the lower quartile; the upper half has two scores in the middle,

71 and 74 so 72.5 is the upper quartile; the IQR = upper quartile 72.5 – lower quartile 54.5; the

IQR = 18.

**(4) 12%**;  $\$94.99 - \$83.99 = \$11$; $11 \div 94.99 \times 100 = 11.58\ldots$ which rounds to 12%.

**(5) 117**; using Order of Operations:  $[\,(10 - 5)^2 + 24 \div 2^3 \times 5 - 7^0\,] \div 1/3$

$$[\,(5)^2 + 24 \div 2^3 \times 5 - 7^0\,] \div 1/3 = [\,25 + 24 \div 8 \times 5 - 1] \div 1/3$$

$$[25 + 3 \times 5 - 1] \div 1/3 = [25 + 15 - 1\,] \div 1/3$$

$$[40 - 1] \div 1/3 = [39] \div 1/3$$

$$[39] \div 1/3 = 39 \times 3/1$$

$$= 117$$

**(6) angle x = 57 º ; angle k = 17 º ; angle m = 54 º ; angle w = 72 º ; angle y = 18 º**

**(7) (a)**The greatest number of bracelets is **15**; find the greatest common factor of 75 and 90 which is 15; **(b)** for the beads of each type: $75 \div 15 = $ **5 gemstones** and $90 \div 15 = $ **6 crystals**.

**(8) -39**; substitute r = 3, = w -5, and h = -4 in the expression:

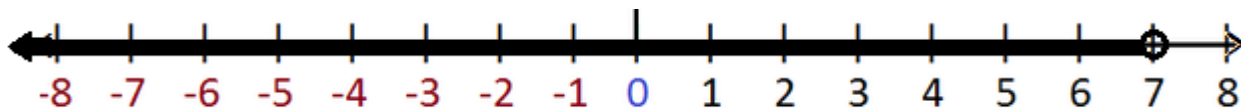$$[ (w - r)^2 + rh ] \div h/r$$

$$[ (-5 - 3)^2 + 3(-4)] \div -4/3$$

$$[ (-8)^2 + -12] \div -4/3$$

$$[ 64 + -12] \div -4/3$$

$$[52] \div -4/3 = 52 \ \text{x} \ -3/4$$

$$= -39$$

**(9) x < 7;** $\ \ -3x + 5 > -16$; $-3x > -21$; $x < 7$; for the graph, the domain on x is all Real numbers.



**(10) 86 2/3 ft. or 86.67 ft.;** set up a proportion such as $26/18 = x/60$ where x is the height of the apartment building; simplify 26/18 to 13/9; $13/9 = x/60$; $9x = 13(60)$; $9x = 780$; $x = 780/9$;

x = 86 2/3 ft. or 86.67 ft.

**(11) y = ½ x + 14**; W(-6, 11) and D(8, 18); find the slope: $(18 - 11) \div (8 - {}^-6) = 7/14$ which

simplifies to 1/2; substitute the coordinates of point W in the equation $y = \frac{1}{2} x + b$:

$11 = \frac{1}{2} (-6) + b$; $11 = -3 + b$; $b = 14$; the equation is $y = \frac{1}{2} x + 14$.

**(12) 2.4 hrs. or 2 hrs. 24 minutes**; Isabella paints at a rate of 1/6 of the deck per hr., Elizabeth paints at a rate of 1/4 of the deck per hr. Together they paint at 1/6 + 1/4= 5/12. Use proportion 5/12 = 1/t where t is the total time together. Solve for t: t = 12/5, t = 2.4 and .4 of 60 minutes is 24 minutes. Algebraically, 1/6 t + 1/4 t = 1; multiply both sides by 24: 4t + 6t = 24; 10t = 24; t = 2.4 hrs. or 2 hrs. 24 minutes.

**(13) (a) The total is 720°** ; (n – 2) 180° ; (4)(180) = 720° ;**(b) Individual angle measure is 120°**; 720/6 = 120 °.

**(14) (a)** line **d; (b)** lines **b and f; (c)** slope = ¯3/2 **(d)** line **e; (e)** line **c; (f)** line **a**

## Calculator Section Answers

**(15) MAD = 9**; the sum of the bagels for ten days is 1,340 and dividing by 10, the mean is 134 bagels; find the absolute value of the difference between the mean and each bagel amount; (0 + 20 + 12 + 7 + 5 + 7 + 22 + 9 + 4 + 4)/10; 90/10 = 9.

**(16) 22 visits**; let x = the number of visits; $80.00 + $8.75x = $12.50 x; 80.00 = 3.75x; 80/3.75 = x; x = 21.3 visits but you can't do a fractional part of a visit so the answer must be rounded up to 22 visits. (Students may have used charts or graphs to find the answer.)

**(17) y = 5/4 x + 9/2**; also accept answers such as **y = 1.25 x + 4.5** or other equivalent equations. In the original equation, the slope was -4/5; a line perpendicular to the given line has a slope of 5/4 because the product of the two slopes is always -1; substitute the coordinates of either point into y = 5/4 x + b in order to find b; -3 = 5/4 (-6) + b; -12 = -30 + 4b; 18 = 4b; so b = 18/4 or 9/2 or 4.5.

**(18) You will have $570 at the end of five weeks; yes, you'll have enough money!** $9.50 times 12 hours equals $114; $114 times 5 weeks equals $570.

**(19) 23 1/3 cups or 23.33 cups**; using proportions, 4 3/8 cups of water/1 cup of concentrate is equal to x cups of water/5 1/3 cups of concentrate; x = 4 3/8 times 5 1/3; 35/8 times 16/3 is equal to 70/3 or 23 1/3 cups or 23.33 cups.

**(20) (a) 240 tiles; (b) the side is 21 ¼ ft. or 21.25 ft.**; $600/$2.49 = 240.9638554 tiles which rounds to 240 tiles; for a square patio the largest size would be 15^2=225 tiles which is 15 tiles per side; since each square tile has an area of 289 sq. ins., the side length must be 17 inches; 15 x 17 = 255 inches; divide 255 inches by 12 inches (number of inches in a foot) and the answer is 21 ¼ ft. or 21.25 ft.

**(21) This is one possible arrangement**; there are other acceptable answers but the sum of all the rows, columns and diagonals, must equal 3.

| 4 | -3 | 2 |
|---|---|---|
| -1 | 1 | 3 |
| 0 | 5 | -2 |