**PSEG Nuclear Salem County Math Showcase**

# 2015 8th Grade Written Challenge

Test Number «testnum»
Date: 4 June, 2015
Time: 30 minutes

# Answer Key

Question 1 **( 10 points ):**

If $\frac{x}{y}=3$ and $x=12$, then $x-y=$

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**Solution:**

Since x = 12 and $\frac{x}{y}=3$,

$\frac{12}{y}=3$

Y = 12/3 = 4

x-y = 12 - 4 = 8

Place Answer Here

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|---|
| x-y = 8 |

Question 2 **( 10 points ):**

If $0.036 = 3.6 \times 10^{t}$, what is the value of $t$?

**Solution:**

To get 0.036 from 3.6, you must move the decimal point two places to the left, so $t$ = -2

Place Answer Here

-2

Question 3 **( 10 points ):**

A special lottery is to be held to select the student who will live in a deluxe room in a college dormitory. There are **100** seniors, **150** juniors, and **200** sophomores who applied. Each senior's name is placed in the lottery **3** times; each junior's name **2** times; and each sophomore's name **1** time.

What is the probability that a senior's name will be chosen?

Note: To determine the probability that a senior's name will be chosen, you must determine the total number of seniors' names that are in the lottery and divide this number by the total number of names in the lottery

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**Solution:**

Since each senior's name is placed in the lottery 3 times, there are 3X100 = 300 seniors' names in the lottery.

Likewise, there are 2x150=300 juniors' names and 1x200 = 200 sophomores' names in the lottery.

The probability that a senior's name will be chosen is

300/(300+300+200) = 300/800 = 3/8

Place Answer Here

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| 3/8 chance that a seniors name is chosen |

Question 4 **( 10 points ):**

Ben and Julie are playing a card game involving green and yellow cards. They get **3** points every time they draw a green card and **5** points for drawing a yellow card. The winner is the first person to reach **50** points. Ben has **41** points and **9** cards.

How many cards of each color does he have?

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**Solution:**

Let G represent the number of green cards
Let Y represent the number of yellow cards

Since Ben has only green and yellow cards and he has 9 of them,
$G + Y = 9$

Since he has 41 points and green are worth 3 and yellow worth 5,
$3G + 5Y = 41$

And we have two equations
$3G + 5Y = 41$
$G + Y = 9$

To eliminate one of the variables, we can multiply the 2nd equation by -3 and add the two equations together,
$3G + 5Y = 41$
$-3G - 3Y = -27$

$2Y = 14$

Then, $Y = 7$ and there are 7 yellow cards
Plugging back into one of the equations,
$G + Y = 9$
$G + 7 = 9$
$G = 2$

Place Answer Here

| 7 yellow cards and 2 green cards |
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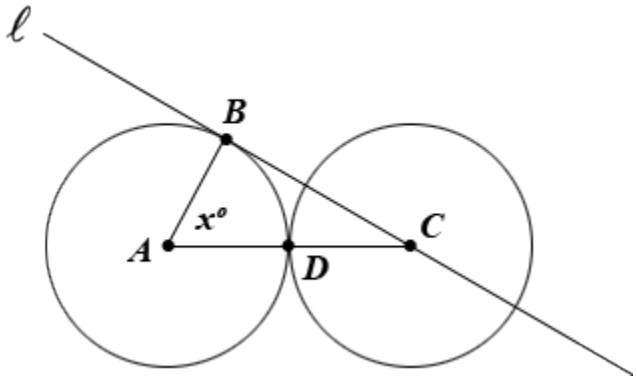
Question 5 **( 10 points ):**




In the figure above, the circle with center $A$ and the circle with center $C$ are tangent at point $D$. If the circles each have radius **10**, and if line $\ell$ is tangent to the circle with center $A$ at point $B$, what is the value of ***X***?

**Solution:**

The circles each have radius **10**, so AB = AD = DC = 10.
Since the circles are tangent at point ***D***, segment AC contains D and AC = 20.

Also, segment AB and $\ell$ are perpendicular because a line tangent to a circle forms a right angle with the radius at the point of tangency. Therefore, triangle ABC is a right triangle with hypotenuse of 20 and side AB of length 10.

A right triangle with one side of length one-half that of its hypotenuse is a $30°-60°-90°$ triangle. The $30°$ angle is opposite side $\overline{AB}$, so the value of X is 90-30 = 60.

Place Answer Here

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| **60 degrees** |

Question 6 **( 10 points ):**

The projected sales volume of a video game is given by the function $s(p) = \frac{3000}{2p + a}$ where S is the number sold, in thousands; P is the price per unit, in dollars; and A is a constant.

If according to the projections, 100,000 units are sold at $10 each, how many will be sold at $20 each?

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Solution:

For 100,000 units sold $10 each, s=100 since S is the number of units sold, **in thousands** and P = 10.

$$100 = \frac{3000}{2(10) + a}.$$

Solving this equation for a,

$$100(20 + a) = 3000$$

$$a = 10.$$

Since a is a constant, the function can be written as $s(p) = \frac{3000}{2p + 10}$.

To determine how many units will be sold at $20 each, we need to evaluate $s(20) = \frac{3000}{2(20) + 10} = 60$.
Since S is given in thousands, there will be 60,000 sold at $20 each.

Place Answer Here

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|---|
| **60,000** |

Question 7 **( 10 points ):**

If $(t-2)^2=0$, what is the value of $(t+3)(t+6)$?

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**Solution:**

$$(t-2)^2=(t-2)(t-2)=0$$

$t-2=0$

$t=2$

Then,

$(t+3)(t+6)=(2+3)(2+6)=5*8=40$

Place Answer Here

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| **40** |

Question 8 **( 10 points ):**

A **25** foot ladder is leaning against a building so that the top of the ladder is **24** feet off the ground. Suppose the ladder slides down so that its top is only **20** feet off the ground.

How far must the bottom of the ladder have slid out along the ground?

**Solution:**

The ladder, the wall of the building and the ground form a right triangle. We know the wall side of the triangle is 24 feet long and that the ladder side of the triangle is 25 feet long. Using Pythagorean theorem:

$X^2 + 24^2 = 25^2$
$X^2 + 576 = 625$
$X^2 = 49$
$X = 7$

After the slide, we know the wall side of the triangle is 20 feet long and that the ladder side of the triangle is 25 feet long. Using Pythagorean theorem:

$X^2 + 20^2 = 25^2$
$X^2 + 400 = 625$
$X^2 = 225$
$X = 15$

$15 – 7 = 8$, so the bottom slide out 8 feet

Place Answer Here

| |
|---|
| 8 feet |

Question 9 **( 10 points ):**

A train passes a **450** meter bridge in **45** seconds and passes a tree in **15** seconds.

How long is the train and what is its speed?

**Solution:**

Assume ***L*** is the length of the train and ***S*** is the speed of the train

Since the train passes a tree in 15 seconds and a tree is a single point then ***L***ength in meters divided by ***S***peed in meters per second will yield the Time to cross the single point.

***L/S*** = 15 seconds

Since a train passes a 450 meter bridge in 45 seconds then,

***(L + 450)/S*** = 45 seconds

Solving both equations for speed,
***S = L/15***
***S = (L + 450)/*** 45

Set these two equal to each other,
***L/15 = (L + 450)/*** **45**
***3L = L + 450***
***2L = 450***
***L = 225***

And since, ***L/S*** = 15 seconds
**225/15 = *S = 15***

Place Answer Here

The length of the train = 225 meters

The speed of the train = 15 meters per second