

**Problem 1****Point 1**

$$2 + 5 \cdot 10^{-4} + 3 \cdot 10^{-2} + 7 \cdot 10^{-1} =$$

- a) 50372                      b) 2.7305                      c) 2.7035                      d) 2.0735

**Problem 2****Point 1**

$$\frac{1}{1 - \frac{1}{1 - \frac{1}{10}}} =$$

- a)  $-\frac{1}{10}$                       b)  $-\frac{1}{9}$                       c) 9                      d) -9

**Problem 3****Point 1**

What is the slope of any line parallel to the line  $9x + 4y = 7$ ?

- a) 9                      b) 7                      c)  $\frac{9}{7}$                       d)  $-\frac{9}{4}$

**Problem 4****Point 1**

What is the greatest common factor of 42 and 210?

- a) 7                      b) 21                      c) 42                      d) 210

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**Problem 5****Point 2**

$$0.3216 : 0.16 =$$

- a) 2.01                      b) 0.16                      c) 20.1                      d) 2.1

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**Problem 6****Point 2**

$$\text{If } (x + y)^2 = 123 \text{ and } xy = -18 \text{ then } x^2 + y^2 =$$

- a) 159                      b) 105                      c) 100                      d) 87

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**Problem 7****Point 2**

If  $m$  and  $n$  are odd integers, which of the following must be true?

- a)  $m^2 + n^2$  is odd;  
b)  $m^2 + n^2$  is divisible by 4;  
c)  $2m^2 + n^2$  is even;  
d)  $(m + n)^2$  is divisible by 4;

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**Problem 8****Point 2**

$c$  is  $83\frac{1}{3}\%$  of what number?

- a)  $\frac{5}{6}c$                       b)  $\frac{6}{5}c$                       c)  $\frac{7}{8}c$                       d)  $\frac{8}{7}c$

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**Problem 9****Point 3**

For which of the following ordered pairs  $(x, y)$  is  $2x + 3y > 6$  and  $x - y > 6$ ?

- a)  $(7; 1)$                       b)  $(7; -1)$                       c)  $(4; -3)$                       d)  $(-3; 4)$

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**Problem 10****Point 2**

The average (arithmetic mean) of five **different** positive integers is 25. If none of the numbers is less than 10, then what is the greatest possible value of one of these numbers?

- a) 59                                  b) 75                                  c) 79                                  d) 85

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**Problem 11****Point 1**

When  $n$  is divided by 12, the remainder is 6. What is the remainder when  $n$  is divided by 6?

- a) 0                                      b) 1                                      c) 2                                      d) 3

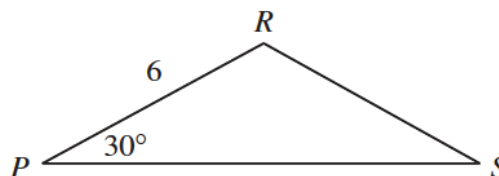
**Problem 12****Point 1**

$5x - 3y = 29$ , and  $x - 3y = 13$ . Find the value of  $2x - 2y$ .

- a) 7                      b) 14                      c) 16                      d) 18

**Problem 13****Point 1**

In the figure, if  $PR = RS$ , what is the area of triangle  $PRS$ ?



- a)  $9\sqrt{3}$                       b) 9                      c)  $9\sqrt{2}$                       d)  $18\sqrt{3}$

**Problem 14****Point 1**

If  $x^3 - y^3 = 55$ , and  $x - y = 11$ , then  $-x^2 - y^2 - xy =$

- a) -5                      b) 5                      c) 8                      d) -8

**Problem 15****Point 1**

For all nonzero real numbers  $p$ ,  $t$ ,  $x$ , and  $y$  such that  $\frac{x}{y} = \frac{3p}{2t}$ , which of the following expressions is equal to  $t$ ?

- a)  $\frac{6py}{x}$                       b)  $\frac{3py}{x}$                       c)  $\frac{3py}{2x}$                       d)  $3x + 12y$

**Problem 16****Point 1**

If  $n = 4$  and  $16 \cdot 2^m = 4^{n-8}$ , then  $m =$

- a)  $-4$                       b)  $-8$                       c)  $-10$                       d)  $-12$

**Problem 17****Point 1**

A circumference of a circle is  $16\pi$ . What is the radius of this circle?

- a) 4                      b)  $8\pi$                       c) 8                      d) 16

**Problem 18****Point 1**

If  $n$  and  $m$  are integers and  $(-1)^n$  and  $(-1)^m$  have the different signs, then

- a)  $m + n$  is odd;  
b)  $m - n$  is even;  
c)  $m + n$  is even;  
d)  $m \cdot n$  is odd.

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**Problem 19****Point 1**

Find the value of the expression  $9^x + 3^{-2x} - 2$ , if it is known that  $3^x - \frac{1}{3^x} = 4$ .

- a)  $-8$                       b)  $-2$                       c)  $9$                       d)  $16$

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**Problem 20****Point 1**

If  $x > 2$ , how many hours does it take a train traveling at  $x - 2$  miles per hour to travel  $x^2 + x - 6$  miles?

- a)  $x + 3$                       b)  $\frac{x-6}{x-2}$                       c)  $x - 3$                       d)  $\frac{x+3}{x-2}$

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**Problem 21****Point 2**

An alloy is composed of the three metals A, B, and C, in the ratio of 2:3:5, respectively, by weight. How many kilograms of metal B is in a 42-kilogram of this alloy?

- a) 12.6                      b) 14                      c) 18                      d) 21

**Problem 22****Point 3**

The average (arithmetic mean) of 5, 8, 2, and  $x$  is 0. What is the median of this set?

- a) 3.5                      b) 6.5                      c) 7.5                      d) 10

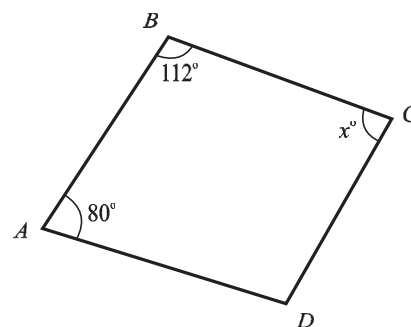
**Problem 23****Point 1**

A rectangle with a perimeter of 30 centimeters is twice as long as it is wide. What is the area of the rectangle in square centimeters?

- a) 15                      b) 50                      c) 150                      d) 200

**Problem 24****Point 1**

In a quadrilateral  $ABCD$ , sides  $AB$  and  $CD$  are parallel for what value of  $x$ ?

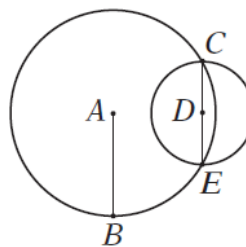


- a) 80                      b) 78                      c) 68                      d) 88

**Problem 25**

**Point 1**

In the figure,  $A$  and  $D$  are the centers of the two circles, which intersect at points  $C$  and  $E$ .  $CE$  is a diameter of the small circle. If  $AB = CE = 12$ , what is  $AD$ ?

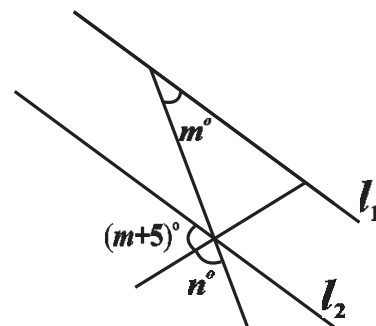


- a) 8                      b)  $6\sqrt{2}$                       c) 9                      d)  $6\sqrt{3}$

**Problem 26**

**Point 1**

In the figure, if  $l_1 \parallel l_2$ , then what is the value of  $n$  in terms of  $m$ ?

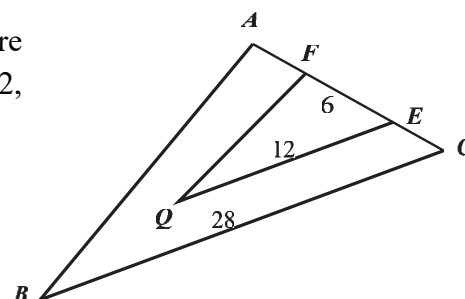


- a)  $355 - 2m$               b)  $185 - 2m$               c)  $175 - 2m$               d)  $85 - 2m$

**Problem 27**

**Point 1**

In the figure,  $\angle BAC = \angle QFE$ ,  $\angle BCA = \angle FEQ$ ,  $F$  and  $E$  are on  $AC$ ,  $AF = EC$ , and distances in centimeters are  $FE = 6$ ,  $EQ = 12$ , and  $CB = 28$ . What is the length of  $AF$ , in centimeters?



- a) 3                      b) 4                      c) 6                      d) 8



**Problem 28****Point 1**

When  $x$  is subtracted from 30 and this difference is divided by  $x$ , the result is 4. What is  $x$ ?

- a) 4                      b) 5                      c) 6                      d) 8

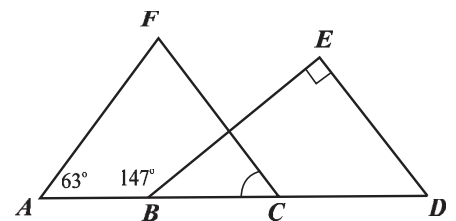
**Problem 29****Point 2**

In the standard  $(x,y)$  coordinate plane three of the vertices of a rectangle are  $(-1; -1)$ ,  $(2; 1)$  and  $(6; -5)$ . Which of the following is the 4th vertex of the rectangle?

- a)  $(1; -8)$               b)  $(3; -9)$               c)  $(2; -7)$               d)  $(3; -7)$

**Problem 30****Point 2**

In the figure,  $A, B, C$  and  $D$  are on one line,  $FC$  is parallel to  $ED$ ,  $BE$  is perpendicular to  $ED$ , and  $\angle FAB = 63^\circ$  and  $\angle EBA = 147^\circ$ . What is the measure of  $\angle FCB$ ?



- a)  $33^\circ$                       b)  $57^\circ$                       c)  $63^\circ$                       d)  $54^\circ$

**Problem 31****Point 1**

Find the second term  $x$ , of the geometric progression  $\frac{1}{4}, x, \frac{1}{36}$ , if  $x > 0$ .

- a)  $\frac{1}{16}$                       b)  $\frac{1}{9}$                       c)  $\frac{1}{12}$                       d)  $\frac{1}{3}$

**Problem 32****Point 1**

What is the degree measure of the acute angle formed by the hands of a clock that reads exactly 1 o'clock?

- a) 10                      b) 15                      c) 20                      d) 30

**Problem 33****Point 1**

If the ratio of  $p$  to  $q$  is 16:5 and the ratio of  $q$  to  $r$  is 15:4, then what is the ratio of  $p$  to  $r$ ?

- a) 12:1                      b) 64:75                      c) 16:15                      d) 3:2

**Problem 34****Point 1**

If  $x \blacksquare y = (x + y)^3 - 3xy$ , then  $(-2) \blacksquare 2 =$

- a) -12                      b) 76                      c) 12                      d) 52

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**Problem 35****Point 1**

If  $\log_a(0.5) < 0$ , where  $a > 0$  and  $a \neq 1$ , which of the following must be true?

- a)  $a \in (2; +\infty)$       b)  $a \in (1; +\infty)$       c)  $a \in (0; 1)$       d)  $a \in \left(\frac{1}{2}; 1\right)$

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**Problem 36****Point 2**

If  $n$  is a positive integer and  $2^n$  is a factor of  $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9$ , what is the greatest possible value of  $n$ ?

- a) 5      b) 7      c) 8      d) 9

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**Problem 37****Point 2**

Which of the following is a factor of the polynomial  $2x^2 - 3x - 5$ ?

- a)  $2x - 3$       b)  $2x - 5$       c)  $2x + 5$       d)  $3x + 5$

**Problem 38****Point 3**

For  $k \neq 0$ , define  $\hat{k}$  by the formula  $\hat{k} = 1 - \frac{1}{k}$ . Find the positive real number  $k$  which satisfies an equation  $\hat{k} = -k$ .

a)  $\frac{\sqrt{5}+1}{2}$

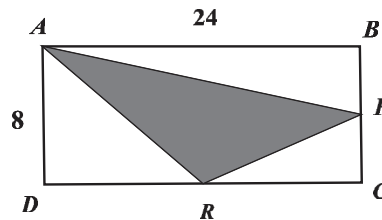
b)  $\frac{\sqrt{3}+1}{2}$

c)  $\frac{\sqrt{3}-1}{2}$

d)  $\frac{\sqrt{5}-1}{2}$

**Problem 39****Point 3**

In the figure,  $ABCD$  is a rectangle where  $P$  and  $R$  are midpoints of their respective sides. What is the area of  $\triangle APR$ ?



a) 54

b) 68

c) 72

d) 96

**Problem 40****Point 3**

Three squares have sides with lengths  $a$ ,  $b$ , and  $c$ . If  $b$  is 20% greater than  $a$ , and  $c$  is 25% greater than  $b$ , then by what percent is the area of the largest square greater than the area of the smallest square?

a) 20%

b) 50%

c) 75%

d) 125%