

# FAIRFIELD COUNTY MATH LEAGUE 2016-2017

Match 5 Round 1  
Algebra I:  
Fractions and  
Exponents

1.) 1.414

2.)  $\frac{25}{7}$

3.)  $\frac{-236a^4b^3c^{12}}{27}$

1) Express as a decimal rounded correctly to three decimal places:

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

2) Express as an integer or reduced fraction:  $\frac{(25)^{-5}(49)^{-3}(35)^4}{(245)^{-2}\left(\frac{7}{25}\right)^3}$

3) Express the following as a single fraction with no negative exponents:

$$\frac{(a)^3 b^8 (8c)^6}{27a^{-1} \left(\frac{1}{4}c\right)^{-6}} - \frac{(5a^2 b^3 c^4)^2 \left(\frac{1}{3}c\right)^4}{(6b)^{-2}}$$

# FAIRFIELD COUNTY MATH LEAGUE 2016-2017

Match 5 Round 2  
Algebra I:  
Fractional  
Expressions and  
Equations

1.)  $\frac{3}{4}$

2.)  $-5, 3$

3.)  $\frac{3}{2(x-2)(x-3)}$  or  $\frac{3}{2x^2-10x+12}$

1). Simplify the product as much as possible if no values of x make any denominators equal to zero:

$$\frac{x^2 + 6x - 27}{6x^2 - 16x - 6} * \frac{9x^2 - 15x - 6}{2x^2 + 14x - 36}$$

2). Solve for all possible values of x:

$$3 - \frac{4}{x+3} = \frac{2x+15}{x+6}$$

3.) Simplify as much as possible:

$$\frac{1}{2x^2 - 10x + 12} - \frac{3}{2x^2 - 5x + 2} - \frac{5}{-2x^2 + 7x - 3}$$

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2016-2017

Match 5 Round 3  
 Geometry:  
 Circles

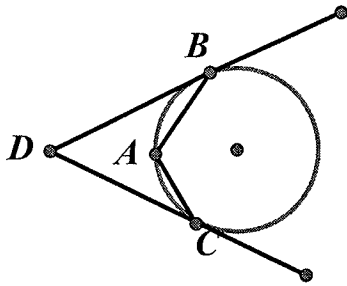
1.) 20 degrees

2.) 8

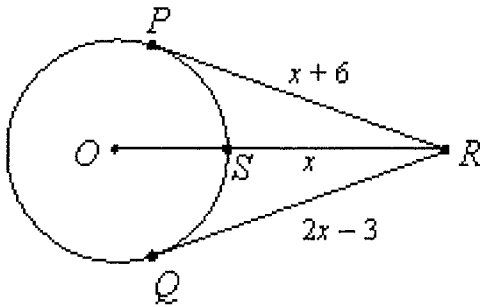
3.)  $100\pi$   $\text{cm}^2$

Note: Diagrams not necessarily to scale.

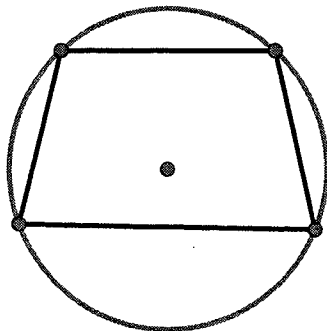
1.) In the picture below,  $\angle BAC$  is inscribed in the circle and  $\overline{DB}$  and  $\overline{DC}$  are tangent to the circle. If the measure of  $\angle BAC$  is 100 degrees, find the measure of  $\angle BDC$  in degrees



2.) The circle below has center O.  $\overline{RP}$  and  $\overline{RQ}$  are tangent to the circle.  $\overline{RO}$  intersects the circle at S. If  $SR=x$ ,  $PR=x+6$ , and  $RQ=2x-3$ , find the radius of the circle.



3.) A circle is circumscribed about an isosceles trapezoid with base lengths 12 cm and 16 cm. The area of the trapezoid is  $196 \text{ cm}^2$ . Find the area of the circle.



# FAIRFIELD COUNTY MATH LEAGUE 2016-2017

Match 5 Round 4  
Quadratic  
Equations and  
Complex  
Numbers

1.) 8 - 2i

2.) -14 < k < 2

3.) i, 1/2

1) Simplify:  $\frac{5i^7 + (3i+4)(6i+7)}{5i}$

2) For what values of k will the equation  $x^2 + 3kx + 2k^2 = -2x - 8$  have two distinct ~~complex~~ solutions? You may answer in inequality notation or interval notation. *NONREAL*

3) Solve for all complex z:  $2z^2 - (1+2i)z + i = 0$

**FAIRFIELD COUNTY MATH LEAGUE 2016-2017**

Match 5 Round 5  
Solving Trig  
Equations

1.)  $\frac{\pi}{10}, \frac{\pi}{2}, \frac{9\pi}{10}, \frac{13\pi}{10}, \frac{17\pi}{10}$

2.)  $0, \pi, \frac{7\pi}{6}, \frac{11\pi}{6}$

3.)  $0, \frac{4}{5}$

1) Solve for all  $x$  if  $0 \leq x < 2\pi$ :  $\sin(5x) = 1$

2) Solve for all  $x$   $0 \leq x < 2\pi$  if  $\cos(2x) - \sin(x) = 1$

3.) If  $\cos(x) + 2\sin(x) = 2$ , what are all possible values for  $\cos(x)$ ?

FAIRFIELD COUNTY MATH LEAGUE (FCML) 2016-2017

Match 5 Round 6  
Sequences and  
Series

1.)  $\frac{5}{6}$

2.)  $2\sqrt{3}, -2\sqrt{3}$

3.)  $\frac{3}{5}, -\frac{1}{45}$

1.) Evaluate  $\sum_{k=1}^5 \frac{1}{k(k+1)}$ .

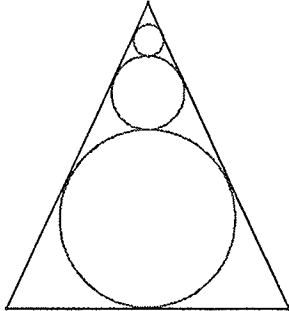
2.) The third term of a geometric sequence of real numbers is 162 and the seventh term is 18. What are the possible values for the tenth term of the sequence?

3. The 257<sup>th</sup> term of an arithmetic sequence is 15 less than the square of the 22<sup>nd</sup> term. If the 7<sup>th</sup> term is 4, find all possible values for the common difference.

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Match 5 Team Round

Note: Diagrams not necessarily drawn to scale



- 1.)  $\frac{63}{16}$       4.)  $i, -i$
- 2.)  $\frac{-12}{13}$       5.)  $\frac{1+3\sqrt{5}}{8}$
- 3.)  $\frac{16}{x^3y^7}$       6.)  $92.16$  (or  $\frac{2304}{25}$ )

1.) The snowperson above is such that the circles are externally tangent to each other as shown and tangent to the sides of an isosceles triangle whose sides measure 10 cm, 10 cm, and 12 cm as shown. Find the sum of the radii of the 3 circles.

2.) Solve the equation  $1 + \frac{2}{3 + \frac{4}{5 + \frac{6}{x}}} = 7$

3.) If  $x \neq 0$  and  $y \neq 0$ , express in simplest form with no negative exponents:  $\frac{(2x)^6(3y^{-5})(4x^3y)^{-4}}{(9y^7)^2(12xy^2)^{-3}}$

4.) A geometric sequence  $\{a_n\}$  of complex numbers has  $a_2 = -1 + i$  and  $a_4 = -2 + 2i$ . Find all possible values for  $a_1$ .

5.) If  $\cos(x + \frac{\pi}{3}) = \frac{1}{4}$ , and  $x$  is in quadrant I, what is  $\cos(x)$ ?

6.)  $\sum_{n=1}^{\infty} a_n = 2500$  and  $\{a_n\}$  is a geometric sequence of real numbers. If  $a_2 = a_1 - 4$ , what are all possible values for  $a_3$ ?