

**FMA Team Mathematics Competition - Zone**  
**YEAR 12 – 2015**

Y12/1 If  $a$  and  $b$  are two distinct numbers with  $\frac{a+b}{a-b} = 3$ , then what will be the value of  $\frac{a}{b}$ ?

\_\_\_\_\_

Y12/2 If  $a + b = 7$  and  $ab = 4$ , then what is the value of  $a^2 + b^2$ ?

\_\_\_\_\_

Y12/3 The remainder when  $p$  is divided by 7 is 4, and the remainder when  $q$  is divided by 7 is 3. What is the remainder when  $pq$  is divided by 7?

\_\_\_\_\_

Y12/4 If 100 men can dig a ditch 6 km long in 60 days, working 12 hours a day, how many hours a day must 75 men work to dig a ditch 3 km long in 48 days?

\_\_\_\_\_

Y12/5 Find the equation of the tangent line at  $(0, 2)$  to the circle with equation  $(x + 2)^2 + (y + 1)^2 = 13$ . Write your answer in the form  $y = mx + c$ .

\_\_\_\_\_

Y12/6 When divided by  $x - 1$ , the polynomial  $P(x) = x^5 + 2x^3 + Ax + B$ , where  $A$  and  $B$  are constants, the remainder is equal to 2. When  $P(x)$  is divided by  $x + 3$ , the remainder is  $-314$ . Find  $A$  and  $B$ .

\_\_\_\_\_

Y12/7 The  $y$  – intercepts of three parallel lines are 2, 3 and 4. The sum of the  $x$  – intercepts of the three lines is 36. What is the slope of these parallel lines?

\_\_\_\_\_

Y12/8  $f(x)$  is a function such that  $f(2x + 1) = 2f(x) + 1$  for all real numbers  $x$  and  $f(0) = 2$ . Find the value of  $f(3)$ .

\_\_\_\_\_

Y12/9 There are two values of  $k$  for which the equation  $x^2 + 2kx + 7k - 10 = 0$  has two equal real roots (that is, has exactly one solution for  $x$ ). What is the sum of these values of  $k$ ?

\_\_\_\_\_

Y12/10 Find the value of  $\log_y(x^4)$  if  $\log_x(y^3) = 2$ .

\_\_\_\_\_

Y12/11 A third grade teacher had a box of pencils to use as prizes for her students. If  $\frac{1}{10}$  of the pencils green,  $\frac{1}{2}$  of them are white,  $\frac{1}{4}$  of them are blue, and the remaining 45 pencils are red, what is the number of blue pencils?

\_\_\_\_\_

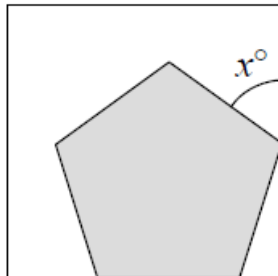
Y12/12 8 carpenters worked from 7.00 am until 4:00pm framing a house. Working at the same rate, how many additional carpenters would be needed for the job to have taken 3 hours less?

\_\_\_\_\_

Y12/13 On an island there are two types of inhabitants: Heroes who always tell the truth and Villains who always lie. Four inhabitants are seated around a table. When each is asked "Are you a Hero or a Villain?", all four reply "Hero". When asked "Is the person on your right a Hero or a Villain?", all four reply "Villain". How many Heroes are present?

\_\_\_\_\_

Y12/14 The diagram shows a regular pentagon inside a square. What is the value of  $x$ ?



\_\_\_\_\_

Y12/15 After I had spent  $\frac{1}{5}$  of my money and then spent  $\frac{1}{4}$  of what was left, I had \$15 remaining. How much money did I start with?

\_\_\_\_\_

Y12/16 what is the sum of all values of  $x$  that satisfy the equation  $(x^2 - 5x + 5)^{x^2 + 4x - 60} = 1$ ?

\_\_\_\_\_

Y12/17 Two boats on opposite banks of a river start moving towards each other. They first pass each other 1400 meters from one bank. They each continue to the opposite bank, immediately turn around and start back to the other bank. When they pass each other a second time, they are 600 meters from the other bank. We assume that each boat travels at a constant speed all along the journey. Find the width of the river?

\_\_\_\_\_

Y12/18 Karen has three times the number of mangoes that Lionel has, and twice the number of mangoes that Michael has. Michael has seven more mangoes than Lionel. How many mangoes do Karen, Lionel and Michael have altogether?

\_\_\_\_\_

Y12/19 Desmond is a physical therapist who specializes in leg injuries. His patients differ in age and type of injury. The probability that a patient is 20-45 years old is 0.2, the probability that a patient suffers from shin pain is 0.3, and the probability that a patient is 20-45 years old and suffers from shin pain is 0.1. What is the probability that a randomly chosen patient is 20-45 years old or suffers from shin pain?

\_\_\_\_\_

Y12/20 There are 81 cars in the MHCC parking lot, which are all TOYOTA, NISSAN, or FIAT. There are half as many TOYOTA as NISSAN. The number of FIAT is 80% of the number of TOYOTA and NISSAN together. How many of the 81 cars are NISSAN?

\_\_\_\_\_

TIE BREAKER

Y12/21 Given that  $\frac{3x+y}{x-3y} = -1$ , what is the value of  $\frac{x+3y}{3x-y}$ ?

\_\_\_\_\_

Y12/22 An oil tanker is 100 km due north of a cruise liner. The tanker sails SE at a speed of 20 kilometers per hour and the liner sails NW at a speed of 10 kilometers per hour. What is the shortest distance between the two boats during the subsequent motion?

\_\_\_\_\_