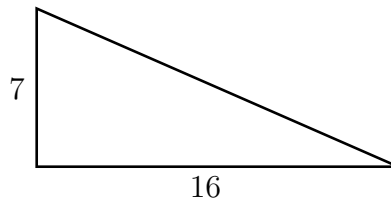


Blitz, Regional 2015, Page 1

1. One person is chosen at random from a group of 5 kids, 2 of whom are girls. What is the probability that the person is a boy? Express the answer as a common fraction. 1. \_\_\_\_\_

2. Let  $N = 1 + 3 + 5 + 7$ . What is the value of  $N$ ? 2. \_\_\_\_\_

3. What is the area of a right-angled triangle whose two smallest sides are 7 and 16? 3. \_\_\_\_\_ units<sup>2</sup>

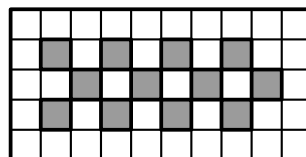


4. You bought three sandwiches at a cost of \$5.75 each. How much did they cost in total? Express your answer in dollars correct to 2 decimal places. 4. \_\_\_\_\_ dollars

5. Let  $N = 20\%$  of  $30\%$  of 200. What is the value of  $N$ ? 5. \_\_\_\_\_

6. Find the average of the terms in the following arithmetic sequence:  $5, 9, \dots, 25$ . 6. \_\_\_\_\_

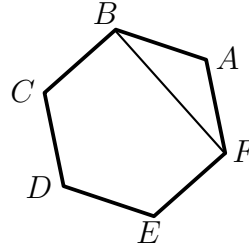
7. What percentage of the rectangle below is shaded? 7. \_\_\_\_\_ percent



Blitz, Regional 2015, Page 2

8. Two fair dice are rolled. What is the probability that we get the same number on both dice? Express your answer as a common fraction. 8. \_\_\_\_\_

9. The regular hexagon  $ABCDEF$  has area 1. What is the area of  $\triangle ABF$ ? Express the answer as a common fraction. 9. \_\_\_\_\_

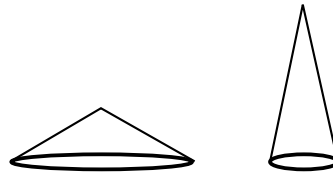


10. Simplify to a single fraction:  $\frac{1}{2} + \frac{2}{3} + \frac{3}{4}$ . 10. \_\_\_\_\_

11. Round  $\frac{243}{23}$  to the nearest integer. 11. \_\_\_\_\_

12. What is the largest prime that divides both 143 and 195? 12. \_\_\_\_\_

13. Cone  $A$  has height  $h$  and base radius  $r$ . Cone  $B$  has height  $4h$  and base radius  $\frac{r}{3}$ . What is the ratio of the volume of cone  $A$  to the volume of cone  $B$ ? Express your answer as a common fraction. 13. \_\_\_\_\_



14. How many factors does 36 have? Note that 1 and 36 are factors of 36. 14. \_\_\_\_\_ factors

Blitz, Regional 2015, Page 3

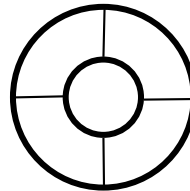
15. The speed of a cargo ship in still water is 10 km/h. If 4 hours are required for that ship to travel 16 km up a river (against the river's current), what is the speed of the river's current, in km/h? 15. \_\_\_\_\_ km/h

16. The speed of a cargo ship in still water is 10 km/h. If the ship is traveling downriver on a river that is flowing at 5 km/h, how many *minutes* does it take for the cargo ship to travel 16 km downriver? 16. \_\_\_\_\_ minutes

17. Express  $\frac{3}{1 \times 2} - \frac{5}{2 \times 3} + \frac{7}{3 \times 4}$  as a common fraction. 17. \_\_\_\_\_

18. You bought a book at a cost of 19.78 US dollars. If a Canadian dollar is worth 0.92 US dollars, how much did you pay in Canadian dollars? Give the answer to two decimal places. 18. \_\_\_\_\_ Can. \$

19. Two solid concentric rings are connected and the inner ring rotates at a rate of 2 m/s. If the radii of the rings are 2 m and 5 m, at what rate does the outer ring rotate (in m/s)? 19. \_\_\_\_\_ m/s



20. If the inner ring in Question 19 rotates at  $\frac{2\pi}{3}$  m/s, what is its rate of rotation in degrees per second? 20. \_\_\_\_\_ deg/s

Blitz, Regional 2015, Page 4

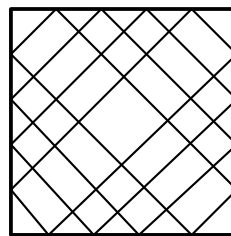
21. In a class of 29 students, 19 got an A in Math. Of the students who did not get an A in Math, four-fifths did not get an A in Language Arts. Overall, 17 students got an A in Language Arts. If you choose a student at random, what is the probability that the student got an A in both Math and Language Arts? Express the answer as a common fraction. 21. \_\_\_\_\_

22. The values of the third and sixth terms of a geometric sequence are respectively  $\frac{15}{8}$  and  $-\frac{405}{64}$ . What is the first term of the sequence? Express the answer as a common fraction. 22. \_\_\_\_\_

23. What is the sum of all of the prime factors of 2015? 23. \_\_\_\_\_

24. A drinking glass with inner diameter 8 cm and height 12 cm is half-full of water. A sphere of diameter 6 cm is carefully lowered into the glass until the sphere is exactly half submerged. By how many cm does the water level in the glass *rise*? Express the answer as a common fraction. 24. \_\_\_\_\_ cm

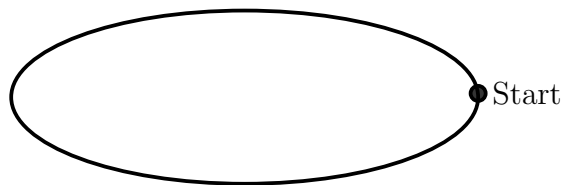
25. All interior lines meet the outer square at a  $45^\circ$  angle. How many right triangles are in the figure below? 25. \_\_\_\_\_



26. A point in the plane is chosen at random from all points with integer coordinates  $(u, v)$  such that  $1 \leq u \leq 9$  and  $1 \leq v \leq 9$ . What is the probability that the absolute value of the difference between the  $x$ -coordinate and the  $y$ -coordinate of the point is greater than 2? Express the answer as a common fraction. 26. \_\_\_\_\_

Bull's-eye, Regional 2015, Page 1: Problem Solving

1. Suppose that 105 kg of brine (which is a solution of water and salt) consists of 20 kg of salt, with the rest water. How many kg of water must be added so that the resulting solution is 8% salt by weight?  
1. \_\_\_\_\_ kg
  
2. A student has a grade of 73% going into the final exam. The final exam is worth 60% of the final grade. What is the grade (in percent) that the student must achieve on the final exam in order to obtain a final grade of 70%?  
2. \_\_\_\_\_ percent
  
3. Between them, Alicia, Beti, Cyril, and Dan own 700 books. Alicia has 40 more books than Beti, 200 more books than Cyril, and 300 more books than Dan. How many books does Alicia own?  
3. \_\_\_\_\_ books
  
4. Amy and Beth walk along a loop in opposite directions, starting from the same place. Amy's speed is  $\frac{7}{5}$  times Beth's speed. They first meet after 24 minutes of walking. How many minutes will it take from the time they meet for the *second* time for Amy to reach the starting point? Express the answer as a common fraction  
4. \_\_\_\_\_ minutes

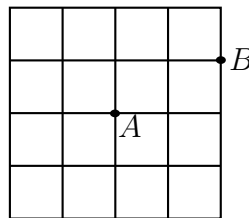


Bull's-eye, Regional 2015, Page 2: Numbers and Combinatorics

5. You have the following collection of beads in your drawer: 10 are white, 4 are black, 3 are blue, 2 are yellow, and 1 is green. You take out of your drawer at least 5 white beads, and at least 1 of each of the other colours. How many different total numbers of beads could you have taken out? 5. \_\_\_\_\_

6. How many *different* prime numbers are factors of 4680? 6. \_\_\_\_\_

7. The figure below shows streets. The line segments that connect adjacent intersections are of unit length. Assume that you walk full segments, and at any intersection you decide which segment to use next (including travelling back along the same segment). In how many ways can you walk along the grid of streets starting and ending at  $A$ , walking through  $B$ , and walking a total of 6 units? 7. \_\_\_\_\_ ways

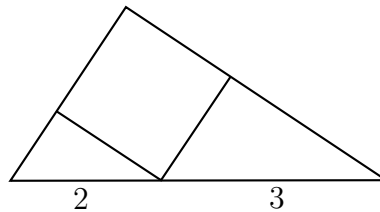


8. Suppose that as in Question 7, you start at  $A$ , and walk a total of 3 segments, not necessarily distinct. If all paths of length 3 are equally likely, what is the probability that you end up at  $B$ ? 8. \_\_\_\_\_

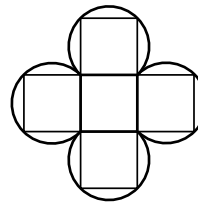
Bull's-eye, Regional 2015, Page 3: Geometry

9. If you increase the radius of the base of a cylinder by 200% and you increase its height by 100%, by how many percent do you increase its volume? 9. \_\_\_\_\_ percent

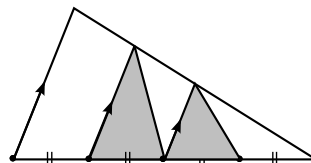
10. In the diagram, the shape that looks like a square *is* a square, and dimensions along the hypotenuse of the big triangle are as shown. What is the area of the square? Express the answer as a common fraction. 10. \_\_\_\_\_ units<sup>2</sup>



11. The cross in the picture is made up of five  $2 \times 2$  squares. The outer curve is made up of four arcs of circles. What is the total area enclosed by the outer curve? Express the answer in terms of  $\pi$ . 11. \_\_\_\_\_ units<sup>2</sup>

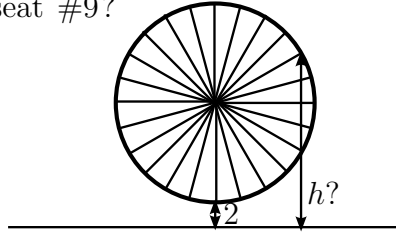


12. The bottom edge of the large triangle has been divided into four equal parts as shown and the three lines that are shown as parallel *are* parallel. What is the ratio of the combined area of the two shaded triangles to the area of the unshaded part of the large triangle? Express the answer as a common fraction. 12. \_\_\_\_\_



Co-op, Regional 2015, Page 1: Team answers must be on the *coloured* page. Answers on a white page will not be graded.

1. A Ferris wheel has radius 12 m and 24 equally spaced seats labelled 1 to 24. Seat #1 is the lowest seat and is 2 m above the ground. How high (in m) above the ground is seat #9?



1. \_\_\_\_\_ metres

2. Find  $N$ :  $N = 1^2 - 2^2 + 3^2 - 4^2 + \dots + 99^2 - 100^2$ .

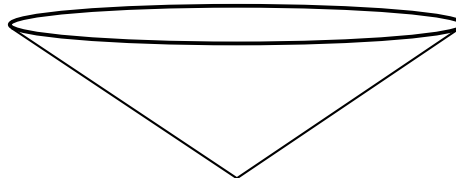
2. \_\_\_\_\_

3. A saleswoman at a street corner rents her stand for \$1500 for a period of 90 days, and pays to the city a usage fee of \$35 per day. She sells souvenirs at a rate of 18 per hour to passers by. If her cost for 20 souvenirs is \$5, and each is sold for \$1, and if she sells for 14 hours every day, how many dollars is her total profit in the 90 day period?

3. \_\_\_\_\_ dollars

4. A conical storage tank of height 10 m and radius  $\frac{27}{\sqrt{\pi}}$  m is used to store water for the local community. The tank was full at the beginning of a 40 day dry period during which no water entered the tank. However, continued water usage caused the tank's water level to fall to  $\frac{1}{3}$  of its maximum height. What was the average daily usage of water, in  $\text{m}^3$  per day, during the 40 day dry period? Give the answer correct to 1 decimal place.

4. \_\_\_\_\_  $\text{m}^3/\text{day}$



5. For the storage tank of Question 4, and water consumption of 54000 litres per day, how many days of water supply can the tank hold? .

5. \_\_\_\_\_ days

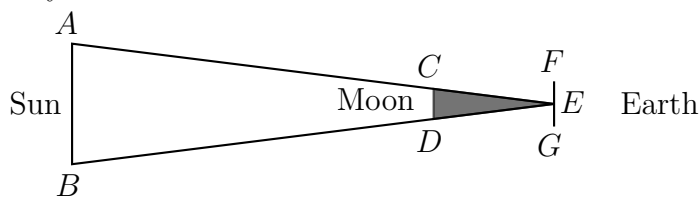


Co-op, Regional 2015, Page 2: Team answers must be on the *coloured* page. Answers on a white page will not be graded.

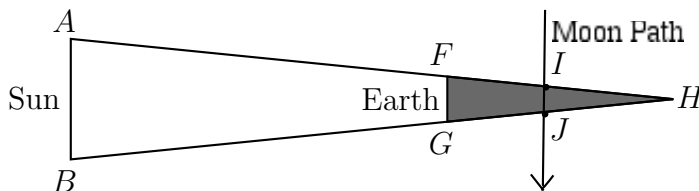
6. The operation  $\&$  is defined by  $a\&b = 2(a + b) - (a + b)^3$ . What is the value of  $(1\&1)\&1$ ? 6. \_\_\_\_\_
7. Positive and negative electrical pulses are sent over an electrical channel to a receiver. A positive pulse represents a ONE (1); a negative pulse represents a ZERO (0). A sequence of these binary digits (bits) is used to transmit data. Two of the many possible 8-bit sequences are: 00110011 and 10101010, How many different possible 8-bit sequences are there? 7. \_\_\_\_\_ sequences
8. Suppose that in Question 7, channel noise causes any bit to be received in error (i.e. a ONE is received as ZERO or ZERO is received as ONE) with probability 0.000011. Suppose also that bit errors are independent of each other (i.e. an error in any specific bit has no effect on whether or not an error occurs in any other bit). What is the largest number of bits that can be transmitted so that the probability that all are received correctly is still larger than 0.999? 8. \_\_\_\_\_ bits
9. Suppose now that in Question 8 the probability of a bit to be received in error through a very noisy channel is 0.1. Suppose also that if a bit is received in error then for each subsequent bit, the probability it is received in error is 0.5. A 4-bit message is sent. What is the probability that at least 3 bits are received correctly? Give your answer correct to 4 significant digits. 9. \_\_\_\_\_
10. Find the sum of all the numbers from 1 to 1111 (inclusive) whose decimal expansion has no digits other than 0 or 1. 10. \_\_\_\_\_

Co-op, Regional 2015, Page 3: Team answers must be on the coloured page. Answers on a white page will not be graded.

11. In questions 11, 12, 13 and 14 you are expected to use similar triangles to approximate some conditions of Solar and Lunar eclipses. The diameter of the Earth is 12714 km (the line  $FG$ ). The distance from the Sun to Earth is 149598000 km (the distance from point  $E$  to side  $AB$  of the isosceles triangle  $ABE$ ). The Sun's diameter is 1392700 km ( $AB$ ). The Moon's diameter is 3475 km (the side  $CD$  of the isosceles triangle  $CDE$  which illustrates the shadow of the Moon). The top diagram shows the case where the Moon is at the furthest distance from Earth and still projects full shadow somewhere on Earth (full solar eclipse). What is the distance (in km) from point  $E$  to line  $CD$ ? Give your answer in km to the nearest 1000 km.



12. The Earth projects its own shadow into space (the isosceles triangle  $FGH$ ). How far from Earth (in km) does this shadow extend (the distance from point  $H$  to  $FG$ )? Note that  $ABH$  is also isosceles. Give your answer to the nearest 1000 km.



13. Use the approximation (to the nearest 1000 km) of the distance from point  $H$  to  $FG$ . Suppose that the Moon travels through the shadow of the Earth (along the line  $IJ$  of the isosceles triangle  $IJH$ ). Suppose that the distance from Earth to Moon at that event is 400000 km (the distance from  $FG$  to  $IJ$ ). How long is the path of the Moon during the event (the length of  $IJ$ )? Give your answer in km to the nearest km.

14. If the Moon travels at 3550 km/hr, how many minutes does it take for it to travel a distance of length 10000 km? Give your answer correct to the nearest minute. This is a typical length of a lunar eclipse.

15. All the points in the  $4 \times 5$  grid below are at distance 1 from their nearest horizontal and vertical neighbours. If you select 2 different points at random, what is the probability that the straight line distance between them is less than or equal to 2? Express your answer as a common fraction.

