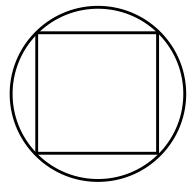
1. Two fair dice are rolled. What is the probability that the sum of the two numbers obtained is 8? Express the answer as a common fraction. 1. ____________

2. A square is inscribed in a circle of radius 11. What is the area of the square? 2. ____________ units^2



3. What is the integer nearest to $(8.5)^2$? 3. ____________

4. Express $\dfrac{37}{91}$ as a decimal, correct to 2 decimal digits. 4. ____________

5. Albert took the same algebra test a total of 3 times. Each time he took the test, the number of questions he answered correctly increased by 50%. If on the last test he got 36 of the 70 questions right, how many questions did he get right the first time he took the test? 5. ____________ questions

6. Express $\dfrac{3^3 - 3^2 - 3^1}{2^3 - 2^2 - 2^1}$ as a common fraction. 6. ____________

7. In 2009, Albert's wage was decreased by 20%. Recently, the resulting wage was increased by 20%. By how many percent is Albert's current wage smaller than his pre-2009 wage? 7. ____________ percent

8. Evaluate $\dfrac{7! - 6! - 5!}{6! - 5!}$. 8. ____________

9. What common fraction is equal to $\dfrac{11}{9} + \dfrac{9}{11} - 2$? 9. ____________

10. Let A be the sum of the *odd* integers from 1 to 39 (inclusive), and let B be the sum of the *odd* integers from 41 to 79 (inclusive). What is the value of $B - A$? 10. ____________

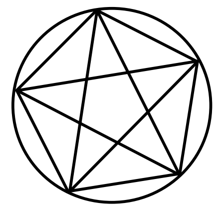
11. The sum of two consecutive primes is divisible by 2 but not by 4. What is the smallest possible value of this sum? 11. ____________

12. Given that the least common multiple of the numbers 8, 10, and n is 80, what is the smallest possible positive value of n? 12. ____________

13. Given that $x^2 = 0.2$, what is the value of x^{-4}? 13. ____________

14. The hypotenuse of a right triangle has length 25 inches. The shorter leg of triangle has length 7 inches. What is the length, in inches, of the longer leg of the triangle? 14. ____________ inches

15. A regular pentagon is inscribed in a circle. You connect any two corners with a straight line. Into how many regions is the circle divided?



15. ____________ regions

16. If x and y are real numbers such that $x + y = 11$ and $xy = 13$, what is the value of $x^2 + y^2$?

16. ____________

17. Every interior angle of a many-sided regular polygon has measure 160 degrees. How many sides does the polygon have?

17. ____________ sides

18. A loonie (1 dollar coin) weighs 4 times as much as a dime (10 cent coin). Bag A contains only loonies, bag B contains 5 times as many dimes as loonies, but no other coins or notes. Bags A and B have exactly the same weight. If bag A contains 45 dollars' worth of loonies, what is the value, in dollars, of the dimes in Bag B?

18. ____________ dollars

19. Let N be the smallest positive integer whose first 4 digits are 2, 0, 1, 0 (in that order) and which is divisible by 45. What is the value of $\frac{N}{45}$?

19. ____________

20. How many numbers from 100 to 999 contain the digit 8 exactly once?

20. ____________ numbers

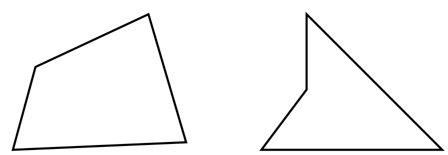
21. A card is removed from a well-shuffled standard 52-card deck, and then a second card is removed. What is the probability the second card is of the same kind as the first card (so if the first card was a 7, the second should be a 7, if the first card was a King, the second card should be a King, and so on. Express the answer as a common fraction. Note that there are 4 cards of each kind.

21. ____________

22. You have 6 tables, whose tops are congruent equilateral triangles, and have guests coming for dinner. You are allowed to join tables together into one or more groups, but if you do, edges of tables that are put together must match up, full edge to full edge. How many different perimeters can we obtained by combining tables in this way?

22. ____________ perimeters

23. A *quadrilateral* is a closed *curve* made up of 4 line segments. (It does not include the "inside," and need not be convex.) If two quadrilaterals have finitely many points in common, what is the largest possible number of common points?

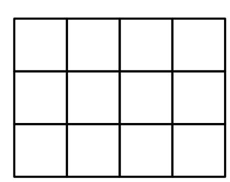


23. ____________ points

24. What is the smallest possible value of $n^2 - 17n + 100$ as n ranges over the integers?

24. ____________

25. The rectangle below is made up of twelve 1×1 squares. Three points, each of which is a vertex of a square, are chosen. Suppose these three points do not all lie on the same line. Form the triangle that has these three points as vertices. How many different numbers are there which could be the area of such a triangle?



25. ____________ numbers

26. You throw a fair coin 6 times. The total number of heads you got is less than 5. What is the probability that the total number of heads is less than the total number of tails? Express the answer as a common fraction.

26. ____________

Bull's-eye, Page 1: Problem Solving

1. A *rod* is 5.5 yards, and a *furlong* is 220 yards. How many rods are there in 6 furlongs?

   1. ____________ rods

2. For every 3 samosas bought at the full price of 40 cents for each samosa, a store offers 2 samosas at half price. What is the largest number of samosas that Alicia can buy for less than \$9?

   2. ____________ samosas

3. In a college class of 60 people, there are 20 men and 40 women. Eighty percent of the men, and fifty percent of the women, are wearing jeans. If a jean wearer in the class is chosen at random, what is the probability that the chosen person is a woman? Express the answer as a common fraction.

   3. ____________

4. Alicia and Beth differ in weight by 20 pounds. Beth and Gamal differ in weight by 30 pounds. And Gamal and Delbert differ in weight by 6 pounds. What is the least possible weight difference between Alicia and Delbert?

   4. ____________ pounds

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

5. What is the sum of all the *distinct* prime factors of 8888? (For example, the sum of the distinct prime factors of 12 is 5.)

5. ____________

6. Three dice are tossed, two red ones and a blue one. What is the probability that the number showing on the blue die matches at least one number showing on a red die? Express the answer as a common fraction.

6. ____________

7. At a restaurant buffet, there are four flavours of ice cream available: durian, lime, mango, and orange. In how many ways can Alan choose two scoops of ice cream? (Durian and lime is the same way as lime and durian, and Alan can choose two scoops of the same flavour.)

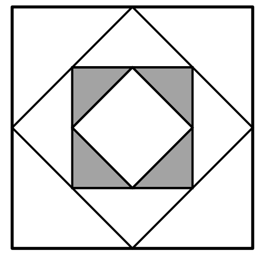
7. ____________ ways

8. What is the sum of all the positive factors of 2013? Note that 1 and 2013 are factors of 2013.

8. ____________

Bull's-eye, Page 3: Geometry

9. All the shapes that look like squares are squares. Each side of the largest square is 8 cm. What is the area, in cm^2, of the shaded region?



9. ____________ cm^2

10. Approximately how much greater is the circumference of a circle of diameter 10007 metres than the circumference of a circle of diameter 10000 metres? Round the answer to the nearest metre.

10. ____________ metres

11. A line has equation $y = mx - 6$. The line passes through the point $(4, 10)$. If the x-ccordinate of a point on the line is 10, what is the y-coordinate of that point?

11. ____________

12. A cube with sides 1 is inscribed in a cone whose base has radius 1 in such a way that one face of the cube is in the base of the cone, and the other four vertices are on the curved surface of the cone. The volume of the cone is πx. Find x. Express the answer as $r + s\sqrt{z}$, where r and s are common fractions and z is an integer.

12. ____________

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

1. Let $A = \dfrac{3^2 - 2^2 - 2}{(\sqrt{2} \times 3^2\sqrt{2}) - 2}$ and let $B = \dfrac{3^2 + 15 - (\sqrt{100} + 5)}{2^2 + 2}$.

   Express $\dfrac{A}{B}$ as a common fraction.

   1. ____________

2. The coordinates of three of the vertices of a rhombus are $(20, 0)$, $(3, 3)$, and $(0, 20)$. What is the sum of the x and y coordinates of the fourth vertex?

   2. ____________

3. Let A be the set consisting of the numbers 1, 2, 3, 4, and 5. In symbols, $A = \{1, 2, 3, 4, 5\}$. Call a subset of A *good* if it contains two numbers that add up to 5. So $\{1, 4\}$ is good, and $\{1, 3, 4\}$ is also good. How many good subsets of A are there? Note that A is a subset of A.

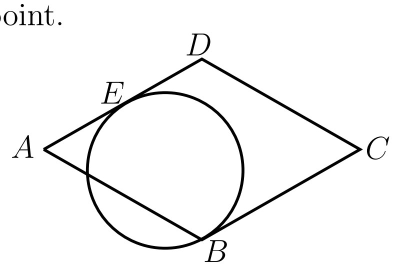
   3. ____________ subsets

4. You are allowed to use pennies, nickels, dimes, quarters, loonies (1$) and toonies (2$) to make any sum of money using two rules. (a) You are not allowed to use more than 4 pennies; (b) if you use more than 6 of one kind of coin, then you are not allowed to use more than three of any other kind. For example, you are allowed to use 7 toonies, 3 loonies, and one each of the other kinds, but you are not allowed to use 7 toonies, 4 nickels, and 3 each of the other kinds. What is the smallest amount of money that you cannot make? Express your answer in dollars correct to 2 decimal digits.

   4. ____________

5. A rhombus $ABCD$ has sides 1, and $\angle DAB$ is $60°$. A circle is tangent to line BC at B, and is tangent to the line segment AD at a point E between A and D.Find the area of the region which is inside the rhombus and also inside the circle. Express the area as a decimal, correct to 3 places after the decimal point.

   5. ____________ units^2



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

6. A ball is dropped from a height of 20 metres. Each time it hits the floor, it bounces to $\frac{8}{9}$ of its previous height. How many times does the ball hit the floor until and including the first time it cannot reach a height of 1 metre?

6. ____________ times

7. The basin of the Yukon River is 476237 km^2. (That means that all the rainfall in that region is drained by that river.) The average yearly rainfall in the basin is 642 mm, and on average 13% of the rainfall is carried by the river to the ocean. How much water on average is carried by the river to the ocean in one day? Assume that there are 365 days per year. Express your answer in km^3, correct to 3 places after the decimal point.

7. ____________ km^3

8. In a certain day (24 hour period) the amount of water that was carried by the Yukon River to the ocean was 1.200×10^8 m^3. At the mouth of the river (the location where the river meets the ocean), the average width of the river was 250 m, and its average depth was 6.0 m. (For simplicity assume that the cross-section of the river at this location is rectangular.) Assume that the water is flowing at constant speed through that cross-section. What was the average speed of the water? Express your answer in m/sec, correct to 3 decimal digits.

8. ____________ m/sec

9. In stationary water, salmon swim (on average) at the speed of 1.2 m/sec as long as the temperature of the water is 10.0 degrees Celsius or less. For each 1 degree rise in water temperature after that, up to a temperature of 20 degrees, salmons' speed is reduced by a constant amount, in such a way that if the temperature is 20 degrees they cannot swim at all. Salmon can swim up the river for at most 20 days until they reach their spawning ground, and their swimming speed is reduced by the speed of the river flow. How far can they reach upriver if the water temperature is 12.0 degrees and if the river flows at 0.5 m/sec? Express your answer in km, rounded to the nearest km.

9. ____________ km

10. You select an integer N from 1 to 100 inclusive, and calculate the sum from $k = 1$ to $k = N$ of k^4, noting the units digit of that sum. What is the average value of these units digits? Express your answer correct to 1 digit after the decimal point. So for example an answer of 6.7 is of the right shape. Hint: Find the units digit for $k = 1, 11, 21, \ldots$ and look for a pattern.

10. ____________

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

11. For any integer $n > 0$, the number $T(n)$ is called the n-th triangular number if $T(n) = 1 + 2 + 3 + \cdots + n$. What is the smallest positive integer n such that $T(n)$ has exactly 16 positive factors? Note that 1 and m are factors of the positive integer m.

11. ____________

12. If you toss a fair nickel 100000 times, it lands heads on average 49912 times, tails 49912 times, and on its edge the rest of the time. You threw the coin 5 times. What is the probability that it landed *exactly* 3 times on its edge. Express the answer in scientific notation, correct to 4 significant digits. An answer like 2.047×10^{-5} is of the right shape.

12. ____________

13. A positive integer is called *square-free* if it is not divisible by any perfect square greater than 1. For example, 1, 2, and 6 are square-free, while 4 and 18 are not. Two fair standard dice are tossed. What is the probability that the product of the two numbers obtained is square-free? Express the answer as a common fraction.

13. ____________

14. A convex polygon has 2013 sides. Let N be the largest integer smaller than 2013 such that $N + 1$ is prime. Using any N corners of this polygon as the corners of a new N-sided convex polygon, how many different N-sided convex polygons can be made? Hint: The correct answer is 10 digits long.

14. ____________ polygons

15. You have a square with side 1, and select a point O at random inside the square, and draw a circle of radius 1 with O as its centre. What is the probability that the entire square is inside the circle? Express the answer as a decimal, correct to 3 decimal places.

15. ____________