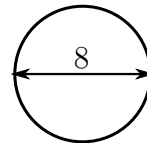1. What is the smallest prime larger than 90?

1. _____

2. What is the digit sum of 2015?

2. _____

3. How many different sums can you get when you throw 3 dice?
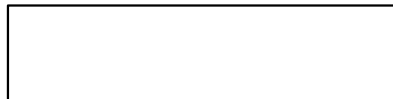
3. _____ sums

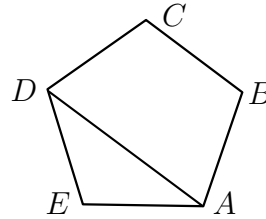4. Round the area of a circle of diameter 8 to the nearest integer.

4. _____

8

5. You add 13 to 10% of N and then you multiply the result by 10 to get 156. What is the value of N?

5. _____

6. What is the smallest 3-digit number all of whose digits are different and which does not use the digit 1?

6. _____

7. If the width of a rectangular billboard is 4 times its height, and if its area is 25 m^2, what is the value of its width, in metres?

7. _____ metres

8. $ABCDE$ is a regular pentagon. What is the value, in degrees, of angle EAD?
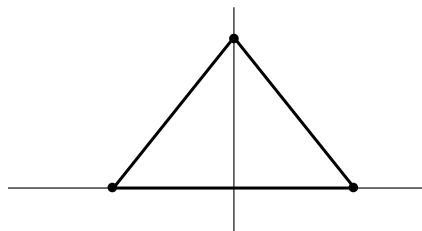
8. _____ degrees

9. What is the greatest common factor of 42, 12, 18, and 132?

9. _____

10. What is the least positive common multiple of the numbers in Question 9?

10. _____

11. What is the binary representation of 2015?

11. _____

12. The first term of a sequence is 0. For $n > 1$, the n-th term is $n! - (n-1)!$. What is the difference between the 6-th term and the 4-th term?

12. _____

13. The vertices of a triangle have coordinates $(-40.3, 0)$, $(40.3, 0)$, and $(0, y)$. What is the positive value of y such that the area of the triangle is 2015?
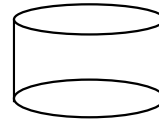
13. _____

14. Express $1 + \dfrac{1}{2} + \dfrac{1}{4} + \dfrac{1}{8} + \cdots + \dfrac{1}{1024}$ as a common fraction.

14. _____

15. Irene went to the store and bought a laptop that was listed for $1000. The laptop was on sale at 15% off. On the amount after the discount, she had to pay 12% tax. How many dollars did she pay in total?

15. _____ dollars

16. Let $N = 100 \times 36 \times 63$. How many factors does N have?

16. _____ factors

17. The volume of a cylinder is 64000π cm^3, and its height is 40 cm. What is the surface area of the cylinder (including both bases)? Provide the answer rounded to the nearest 100 cm^2.
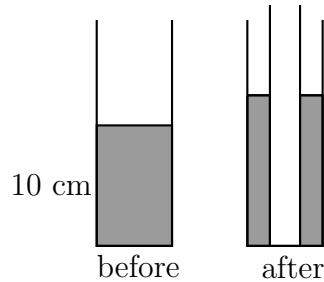
17. _____ cm^2

18. The sum of 40 distinct positive integers is equal to 1000. What is the smallest possible value of the biggest integer?

18. _____

19. Good garden compound can be made by combining 8 bags of 25 litres topsoil at density of 2/5 kg/litre, 4 bags of 30 litres mushroom compost at density of 1/3 kg/litre, and 1 bag of 25 litres of fertilizer at density of 6/5 kg/litre. By weight, what percentage of the compound is fertilizer?

19. _____ percent

20. After mixing, the volume of the compound in Question 19 shrinks to 80% of the original combined volumes of the components. What is the final volume of the compound in litres?
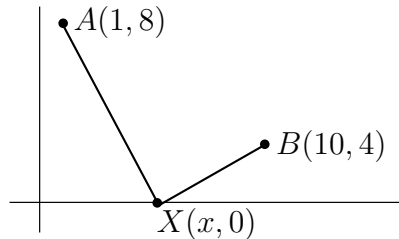
20. _____ litres

21. Round the cube root of 2015 to the nearest integer.

21. _____

22. A 5 cm diameter cylinder is partially filled with water so that the top surface of the water is 10 cm above the bottom. A tall 2 cm diameter solid cylinder is inserted in the larger cylinder so that its bottom touches the bottom of the larger cylinder. What is the new distance from the surface of the water to the bottom of the larger cylinder? Express the answer in cm, as a common fraction.

22. _____ cm

10 cm

before   after

23. Frank rents a stand to sell cloth. His average cost for an item is $5.00, and he has to pay to the owner of the stand 5% of the selling price. At what price does he have to sell the item so that his net profit per item sold is $3.00? Give the answer in dollars, correct to 2 places after the decimal point.

23. _____ dollars

24. Points $A(1, 8)$ and $B(10, 4)$ have been connected by lines to point $X(x, 0)$. What is the smallest possible value of $AX + XB$?

24. _____

$A(1, 8)$

$B(10, 4)$

$X(x, 0)$

25. In Question 24, what is the value of x?

25. _____

26. For every km that a locomotive goes, it burns 5 litres of fuel. For any car that it pulls, it burns (on average) another 0.15 litres of fuel per km. A very long train made up of 1 locomotive and many cars is travelling between 2 refueling stations, a distance of 850 km. If the fuel capacity of the locomotive is 15470 litres, how many cars can the train have?

26. _____ cars

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

1. Two tablets cost $50 more than one laptop. If a tablet costs $294, what is the cost of a laptop, in dollars?

    1. _____ dollars

2. A new animal has evolved in Canada. It is 1/4 coyote, 3/32 wolf, and the rest is dog. What fraction of the animal is dog?

    2. _____

3. The 9 squares in the 3×3 magic square below are to be filled in so that the sum of the three numbers in any row, the sum of the three numbers in any column, and the sum of the three numbers in each of the two diagonals, are all the same. Numbers in some of the squares have already been filled in. Find the number which should be put in the square labelled "?".
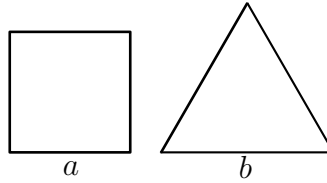
    3. _____

10	3	
		?
−3		

4. A cargo train carries 4 kinds of products, oil, gas, coal, and potash. The amount of gas by weight is 1/8 of the amount of oil. The amount of coal is 1/10 of the combined amounts of potash and gas, and the amount of potash is 5/6 of the combined amounts of gas and coal. What fraction of the total amount is the oil?

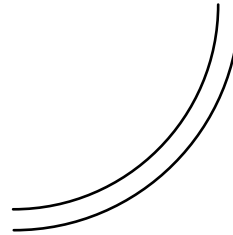   4. _____

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

5. The sum of opposite faces of a traditional die is always 7. Two dice are rolled and the sum of the top faces is greater than 8. How many possible sums can the bottom faces have?

5. _____ sums

6. As in Question 5, the sum of the top faces is greater than 8. What is the probability that there is no 1 on any of the bottom faces? Express the answer as a common fraction.

6. _____

7. What is the smallest positive integer which is divisible by 45 and whose decimal representation uses only the digits 0, 1, and 2?

7. _____

8. How many positive multiples of 3 or 5 or 134 are there that are less than 2015?

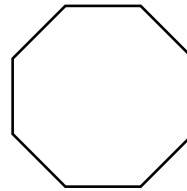8. _____

Bull's-eye, Page 3: Geometry

9. A square of side a and an equilateral triangle of side b have the same area. Express the value of $\frac{b^4}{a^4}$ as a common fraction.
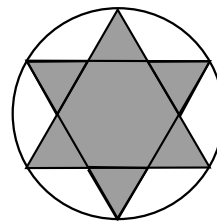
9. _____

10. Railway tracks form the shape of a quarter-circle. The distance between the tracks is 56 inches. How much longer is the outer track than the inner track? Provide your answer to the nearest inch.

10. _____ inches

11. Find the area of a regular octagon with side 1. Express your answer as $k\left(m + \sqrt{n}\right)$, where k, m, and n are integers and n is prime.

11. _____ units^2

12. A star of David with area A is inscribed in a circle with area 3π. What is the value of A^2?
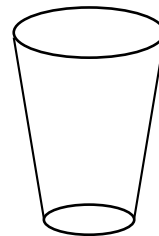
12. _____

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

1. The Fibonacci sequence (F_n) is defined as follows: $F_1 = 1$, $F_2 = 1$ and for $n > 2$ by $F_n = F_{n-1} + F_{n-2}$. Find the largest n such that $F_1 + F_2 + F_3 + \cdots + F_n < 100$.

1. _____

2. In Question 1, what is the value of $F_1 + F_2 + F_3 + \cdots + F_{15}$?

2. _____

3. For every integer $n \geq 1$, the sum of the first n terms of a sequence is equal to n^2. What is the 100-th term of the sequence?

3. _____

4. A pail is placed outside to catch rainfall. The pail has the shape of a truncated cone with base diameter 30 cm, opening diameter 50 cm, and a height of 60 cm. Initially the water level is at 10 cm above the bottom of the pail. A few days later the water has risen to a level of 20 cm from the bottom of the pail. How many cubic cm of water were added? Round your answer to the nearest 100 cm^3.

4. _____ cubic cm

5. If in Question 4 the rainfall is at the rate of 10 mm/hour, how many hours will it take to fill the entire pail if originally it was empty? Round your answer to the nearest integer.

5. _____ hours

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

6. How many ordered triples (a, b, c) of real numbers are there such that each of the numbers is the product of the other two? Note that for example the ordered triple $(2, -3, 0)$ is not the same as the ordered triple $(-3, 0, 2)$.

6. _____ triples

7. A group of 50 kids were chatting over the internet. Each of them sent a different odd number of text messages, except for 3 kids who each sent the same odd number of messages. What is the smallest number of text messages that could have been sent?

7. _____ messages

8. Nimoy drives a car starting at a speed of 0 km/h and accelerating at a constant rate, and driving along the circular road around CERN (the Large Hadron Collider). When he finished one circle he reached a speed of 120 km/h. It took him exactly 1720 seconds to reach that speed. Find the radius of the circle in km correct to one decimal.

8. _____ km

9. You throw three dice. What is the probability that the sum is a multiple of 5? Express the answer as a common fraction.

9. _____

10. The class of 1983 has gathered for a reunion in 2015 to celebrate their 50-th birthdays (all were born in 1965 which had 365 days). Of the 365 days, 310 have no birthday of any of the students. K days have the birthday of 1 student, $K - 1$ days have the birthdays of 2 students, $K - 2$ have the birthdays of 3 students, and so on. So 3 days have the birthdays of $K - 2$ students, 2 days have the birthdays of $K - 1$ students, and 1 day has the birthdays of K students. How many students were in the class of 1983?
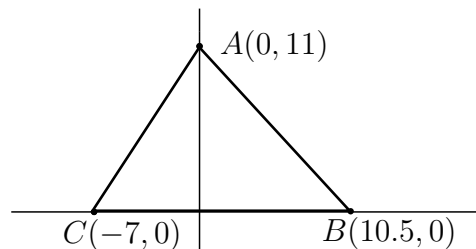
10. _____ students

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

11. Niki generates a 4-character PIN (password) using the allowed 10   11. _____ passwords
digits, 26 lower-case letters, and 26 upper-case letter. She plans to
use exactly 2 (not necessarily different) digits and 2 letters. How
many different passwords can she select from? Examples of valid
passwords: 13Aa, 13aa, A22b, and c3D1.

12. If as in Question 11 Niki plans to use exactly 2 digits and exactly 3   12. _____ passwords
letters for a 5 character password, how many different passwords can
she select from if the 2 digits must be next to each other? Examples
of valid passwords: 00AAb, o12bC, XY98Z.

13. The vertices of triangle ABC have coordinates $A(0, 11)$, $B(10.5, 0)$,   13. _____
and $C(-7, 0)$. Find the area of $\triangle ABC$. Express your answer correct
to 2 decimal places.

14. Triangle ABC is as in Question 13. Find the x-coordinate of the   14. _____
point (x, y) that has the same distances from A, B, and C. Give the
answer correct to 2 decimal places.

15. What is the y-coordinate of the point (x, y) of Question 14? Give   15. _____
the answer correct to 2 decimal places.