Trial

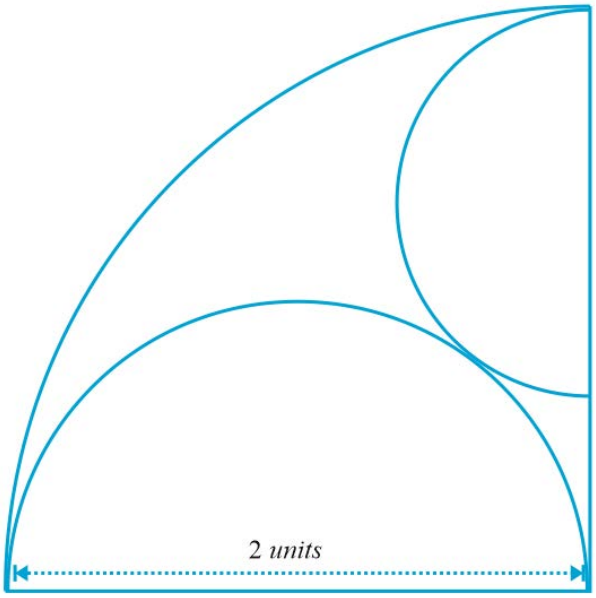
1 Find $\sqrt{a+b+c}$ where

a = the number of *real* roots of the equation $32x^4 - 2 = 0$,

$b = (m+n)^4$ where $m^2 + n^2 = 8$ and $mn = 2$,

$c = \left(2\sqrt{7}+\sqrt{5}\right)\left(2\sqrt{7}-\sqrt{5}\right)$

2 The radius of the quadrant of a circle is 2 units, and the diameter of the large semicircle is also 2 units. Find the radius of the small semicircle.



3 A sequence is formed as follows

$3^2 + 4^2 = 5^2$

$5^2 + 12^2 = 13^2$

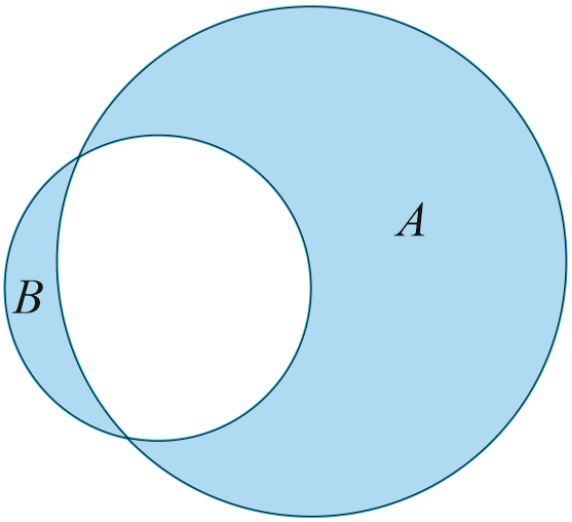
$13^2 + n^2 = (n+1)^2$

$(n+1)^2 + m^2 = (m+1)^2$

Find $m + n$

Set 1

1 The small circle passes through the center of the large circle. The area of the small circle is half that of the large circle. What is the ratio of area *A* to area *B*?



2 Three fair dice are thrown. What is the probability that the numbers they land on will have a product of 100 or more?

3 In a certain sequence, the first number is 1. For all $n \geq 2$, the product of the first n terms of the sequence is n^2. If the sum of the third and fifth terms of this sequence is $\frac{a}{b}$ such that a and b have no common factors, find $a + b$.

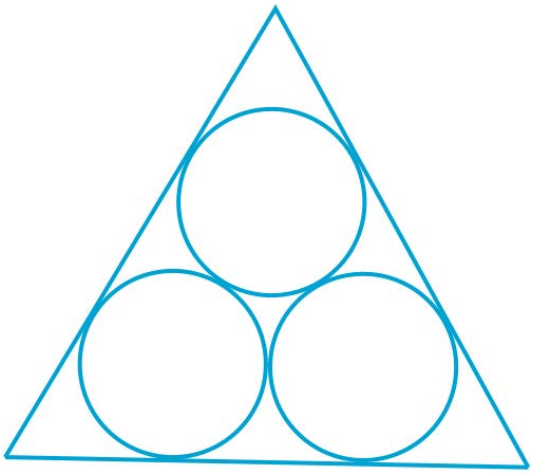
Set 2

4 What is the largest prime factor of 999999000?

5 The two variables x and y are given. The values of y corresponding to some values of x are given in the table below. Find the equation of the function relating y to x and express it in the form y = ??

x	0	1	2	3	4
y	100	90	70	40	0

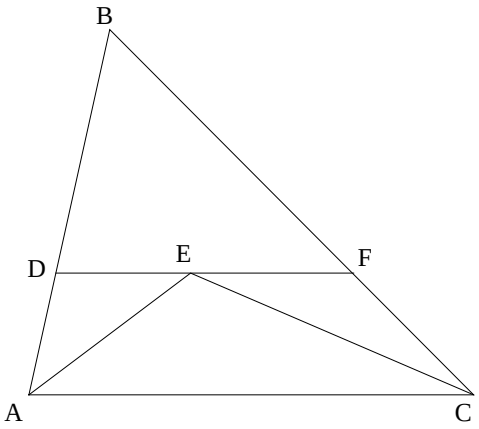
6 Find the area of the triangle if each of the three circles has a radius of 1 cm. (The circles are tangent to each other and to the sides of the triangle).



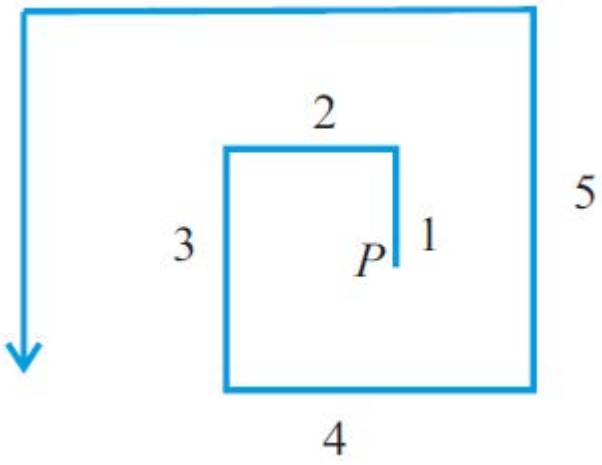
Set 3

7 In the diagram it is given that:

AE bisects $\angle DAC$, *CE* bisects $\angle FCA$, *DF* is parallel to *AC*, *AB* = 12, *BC* = 18, and *AC* = 24. Find the perimeter of ΔBDF



8 You begin at a point P and walk 1 m north, 2 m west, 3 m south, 4 m east, 5 m north, and so on. What is your direct distance from the starting point when you turn south for the ***tenth*** time?



9 If $b, c \in \{1, 2, 3, 4, 5\}$, find the probability that equations of the form $x^2 + bx + c = 0$ will have real roots. (b and c do not have to be different)

Set 4

10 A pyramid has a square base of size 4 cm and its faces are all equilateral triangles. Find the volume of this pyramid.

11 Exactly three of the interior angles of a convex polygon are obtuse. What is the maximum number of sides of such a polygon?

12 $7! = 7\times6\times5\times4\times3\times2\times1 = 5040$ ends with one zero.

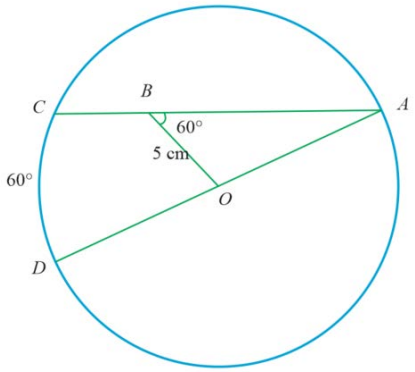
$9! = 9\times8\times7\times6\times5\times4\times3\times2\times1 = 362880$ also ends with one zero.

$11! = 11\times10\times9\times8\times7\times6\times5\times4\times3\times2\times1 = 39916800$ ends with two zeros.

How many zeros are at the end of ‘2022!’?

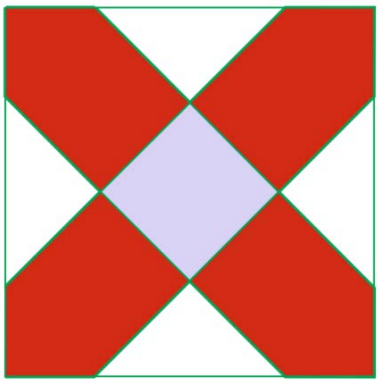
Set 5

13 *AD* is a diameter of circle, entre *O*. *AC* is a chord and point *B* is a point on this chord such that *BO* = 5 cm. Angle *ABO* and Arc *CD* have a measure of 60° each. Find the length of *BC*.



14 *a* and *b* are positive integers less than 100. What is the probability that the units digit of the integer $3^a + 7^b$ is 8?

15 A design is made of a square that has a red cross of uniform width with a blue square in the middle as shown and white background. If the entire cross (both colours) takes up 36% of the area of the square design, what percent of the whole design is blue?

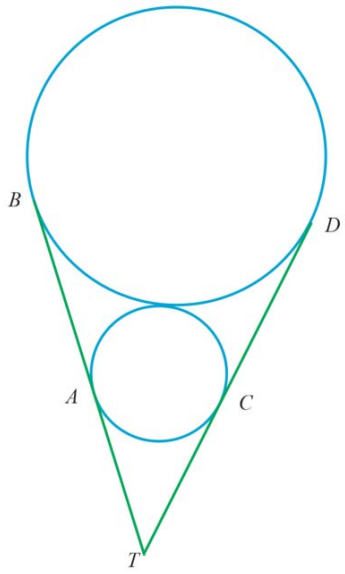


Set 6

16 How many ordered pairs (a, b) of positive integers are solutions to

$\frac{4}{a}+\frac{2}{b}=1$?

17 Two circles are externally tangent. *TAB* and *TCD* are two common tangents as shown. If *TA* = *AB* = 4 cm, find the area of the small circle.



18 Let $u_1, u_2, \ldots, u_n$ be a finite arithmetic sequence such that

$$u_4 + u_7 + u_{10} = 17, \text{ and}$$

$$u_4 + u_5 + u_6 + \cdots + u_{12} + u_{13} + u_{14} = 77$$

Find *n* if $u_n = 13$.