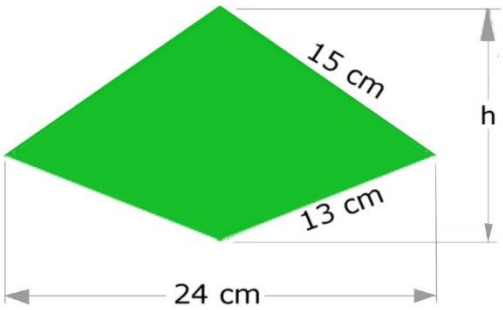
Logic and Maths Puzzles # 75 October 2018

1.



The green shape in the above diagram is a kite. It is vertically symmetrical.
Its width is 24 cm and its sides are 15 cm and 13 cm long.

a. What is its height h in centimetres?

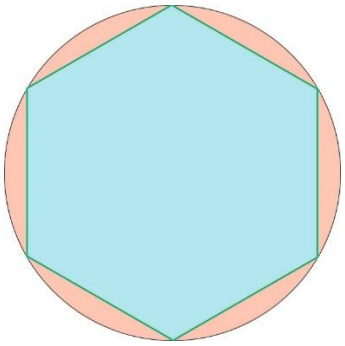
b. What is its area in square centimetres?

2. Six smarties (or M & Ms) are placed in a jar; two red, 2 green, 2 yellow.
A person is then blindfolded and asked to take the smarties out of the jar one at a time.

a. What is the chance that the first two smarties taken from the jar will be red?

b. What is the chance that the first three smarties taken from the jar will be different colours?

3.



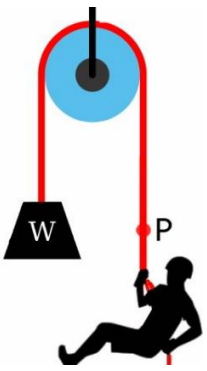
The diagram shows a regular hexagon inside a circle.

Is the combined area of all six pink regions closest to:

10%, 15%, 20%, 25% or 30%

of the area of the blue hexagon?

4.



The picture shows a frictionless pulley, a weightless rope, a man at one end of the rope and a weight at the other end of the rope that has the same mass as the man.

a .What (if anything) will happen to the mass as the man climbs up the rope?

b. If the man climbs 1 m up the rope, in what direction will point P move?

c. How far will point P move?

5. Ann, Bob, Chris and Dane recently played a video game.

Each child used a different avatar (giant, lion, pixie or rabbit)

One child had the White Wizard's help, one child was assisted by the Gray Wizard, one child used both wizards and one child required no help from either wizard.

The pixie wasn't Ann's avatar.

Dane's avatar wasn't the giant.

The child who played as the rabbit didn't seek the help of a wizard.

Of Chris and Dane, one played as the lion and and the other was assisted by both wizards.

The one who played as the pixie sought the aid of the white wizard

(a) Which child used the pixie avatar?

(b) Which child had the Gray Wizard's help?

(c) Which avatar did Dane use?

	Giant	Lion	Pixie	Rabbit	Both Wizards	Gray wizard	White wizard	No Wizard
Ann								
Bob								
Chris								
Dane								
Both Wizards								
Gray Wizard								
White wizard								
No wizard								

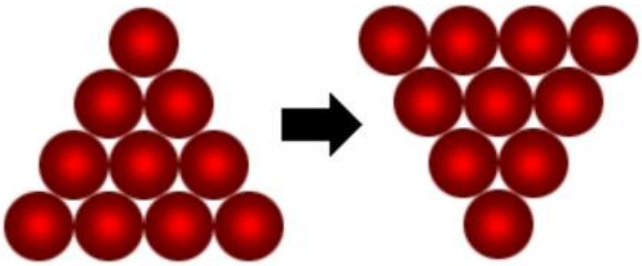
6. A tramp can use the tobacco from six cigarette butts to roll one new cigarette. How many cigarettes can he make from thirty six cigarette butts?

7. If North is 0 and 360 degrees and East is 90 degrees, how many degrees is South-West?

8. In a right-angled triangle whose shortest sides are eight and fifteen metres how long is the other side?

9. Somebody at a party introduces you to your mother's only sister's husband's sister–in-law. He has no brothers. What is this lady to you?

10.

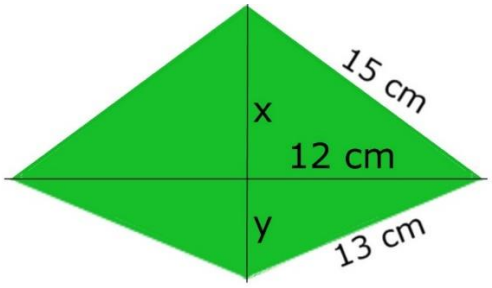


What is the minimum number of balls that it is neccessary to move to turn the arrangement on the left into the arrangement on the right?

ANSWERS:

1. a. 14 cm b. 168 square centimetres

The figure can be shown to consist of four right-angled triangles.



By Pythagoras,

$15^2 = x^2 + 12^2$
$x^2 = 15^2 - 12^2$
$x = 225 - 144 = 81$
$x = 9$

$13^2 = y^2 + 12^2$
$y^2 = 13^2 - 12^2$
$y = 169 - 144 = 25$
$y = 5$

h = x + y = **14 ; the height h is 14 cm.**

The area will be the total area of the four right-angled triangles. That simplifies to (h X 24) / 2 = (14 X 24) / 2 = **168 square centimetres**

2. a. 1/15 b. 2/5

a. There are 2 red, 2 green and 2 yellow smarties in the jar. The chance of taking out a red smartie first is 2/6 or 1/3.

If you take out a red smartie in the first draw, that leaves 1 red 2 green and 2 yellow smarties in the bag. The chance of taking out a second red smartie is 1/5.

The chance of taking out 2 red smarties consecutively is thus 1/3 X 1/5 = 1/15.

b. There are 2 red, 2 green and 2 yellow smarties in the jar. You are certain to take one of the three colours out first.

Let's say you removed a red smartie first.

There would be 5 smarties left in the jar, 1 red, 2 green and 2 yellow. Your chance of next removing either a green smartie or a yellow smartie (but not the other red smartie) is 4/5.

Let's say you removed a green smartie second.

There would be 4 smarties left in the jar, 1 red, 1 green and 2 yellow. Your chance of removing a yellow smartie on the third draw is 2/4 or 1/2.

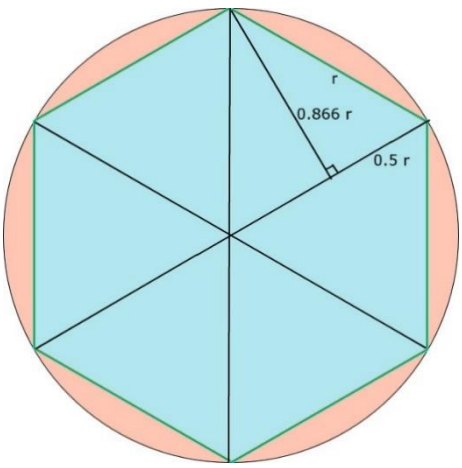
The chance of drawing three different colours consecutively in any order is 1 X 4/5 X 1/2 = 4/10 or 2/5

3. Closest choice is 20% (The actual answer is approximately 20.9%)

The hexagon can be thought of as 6 identical equilateral triangles.
The base of each triangle is the same as the radius of the circle.

Call it "r".

Then using Pythagoras's theorem to calculate the altitude of each triangle



$h^2 = a^2 + b^2$
$a^2 = h^2 - b^2$
$a^2 = r^2 - (0.5\ r)^2$
$a^2 = r^2 - 0.25\ r^2$
$a^2 = 0.75\ r^2$
$a = 0.866\ r$

The area of each equilateral triangle is base X altitude / 2
= [r X 0.866 r] /2 = 0.433 r^2
The area of the hexagon is 6 X 0.433 r^2 = 2.598 r^2
The total area of the circle is $\prod r^2$ or about 3.141 r^2 So the pink area is about 3.141 r^2 – 2.598 r^2 = 0.543 r^2
That's (0.543 / 2.598) X 100 or 20.9 %

4. a. the weight will rise b. downwards c. 2 m

5. (a) Bob (b) Dane (c) Lion

(step 1) If we use the table to score a ✓ for every positive match in the clues and an X for every bit of information we know is NOT true then just following the clues gives us:

	Giant	Lion	Pixie	Rabbit	Both Wizards	Gray wizard	White wizard	No Wizard
Ann		X	X		X			
Bob		X			X			
Chris								
Dane	X							
Both Wizards		X	X	X				
Gray Wizard			X	X				
White wizard	X	X	✓	X				
No wizard	X	X	X	✓				

From the table we can see that the only possibility remaining for the child that used both wizards is the one who used the giant avatar.

(step 2) The only possibility for the child who was assisted by the Gray Wizard is the one who used the lion avatar ✓

	Giant	Lion	Pixie	Rabbit	Both Wizards	Gray wizard	White wizard	No Wizard
Ann		X	X		X			
Bob		X			X			
Chris								
Dane	X							
Both Wizards	✓	X	X	X				
Gray Wizard	X	✓	X	X				
White wizard	X	X	✓	X				
No wizard	X	X	X	✓				

(Step 3) We can now make some more useful connections because we know that **the child who played as the giant and the child who used both wizards** are the same child.

The child who played as the lion and the child who used the Gray Wizard's help are the same child.

The child who played as a pixie and **the child who used the help of the white wizard** are the same child

	Giant	Lion	Pixie	Rabbit	Both Wizards	Gray wizard	White wizard	No Wizard
Ann	X	X	X		X	X	X	
Bob	X	X			X	X		
Chris								
Dane	X							
Both Wizards	✓	X	X	X				
Gray Wizard	X	✓	X	X				
White wizard	X	X	✓	X				
No wizard	X	X	X	✓				

(Step 4) It's now possible to complete the table

	Giant	Lion	Pixie	Rabbit	Both Wizards	Gray wizard	White wizard	No Wizard
Ann	X	X	X	✓	X	X	X	✓
Bob	X	X	✓	X	X	X	✓	X
Chris	✓	X	X	X	✓	X	X	X
Dane	X	✓	X	X	X	✓	X	X
Both Wizards	✓	X	X	X				
Gray Wizard	X	✓	X	X				
White wizard	X	X	✓	X				
No wizard	X	X	X	✓				

Ann played as the rabbit and did not have the assistance of either wizard. Bob was the pixie and was helped by the White Wizard. Chris played as the giant and had the help of both wizards. Dane was the lion, with the Gray Wizard's help

6. 7

He can make 6 new cigarettes from the butts of the original 36. He can then make one new cigarette from the butts of those 6.

7. 225^0

8. 17 metres

$H^2 = A^2 + B^2$

$H^2 = 8^2 + 15^2$

$H^2 = 64 + 225$

$H^2 = 289$

$H = \sqrt{289}$

$H = 17$

9. Your mother

10. 3