Round 1

_____

Question 1

Make the following statement correct by inserting

$$+, -, \times \textbf{ OR } \div$$

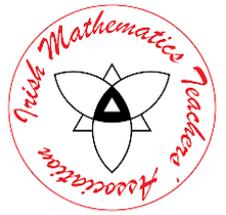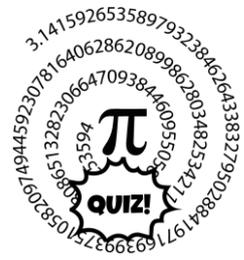into the boxes on your answer sheet without changing the order of the numbers

3 ☐ 6 ☐ 10 ☐ 8   =   13

Question 2

A rectangular swimming pool measures 20 metres by 10 meters. The pool has a uniform depth of 2 metres. The pool is emptied and refilled with fresh water at a rate of 1,000 litres per minute. How many minutes does it take to refill the pool?

(**Note**: $1 \, m^3 = 1000 \, litres$)
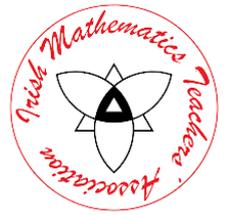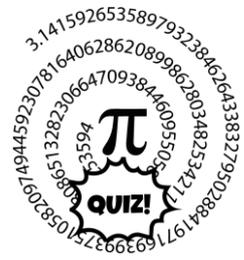
Round 2

_____

Question 1

Solve the simultaneous equations

$$5x + y = 19$$

$$2x - y = 2y - 2x$$

Question 2

The sum of two numbers is 16. Their product is 55. What are the two numbers?
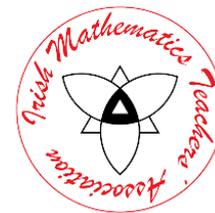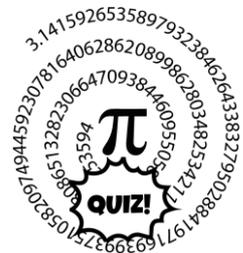
Round 3

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Question 1

What is the angle between the hour hand and the minute hand of a clock at 4:15?

Question 2

What is the sum of all positive integers from 1 to 100, inclusive?
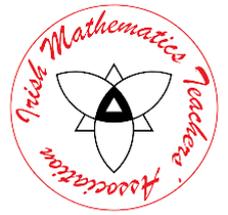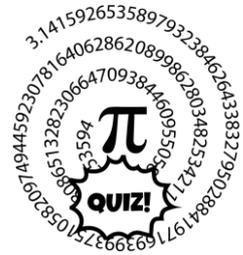
Round 4

_____

Question 1

A person travelled at an average speed of 72 km/hr for 4 hours and 20 minutes.

How far did the person travel, in metres?

Question 2

Let f be the function $f(x) = -x^2 - 4x + 5, \ x \in R.$

Solve $f(x) = f(x + 1).$

Round 5

Question 1

P is the point (2, -3) and *Q* is the point (-2, 1). If *R* is the midpoint of [*PQ*] and *k* is the line through R, perpendicular to [*PQ*], find the equation of *k,* in the form $y = mx + c$.

Question 2

Adesola borrows €5000 for three years at 4% per annum compound interest. She repays €1800 at the end of each of the first two years. How much must she repay at the end of the third year to clear her loan?
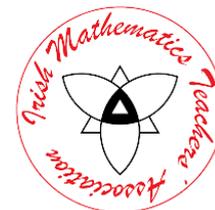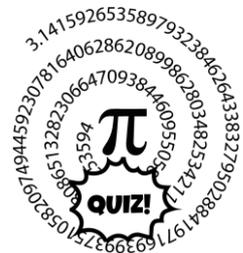
Question 3

The following six numbers have a median of 15, a mean of 18, and a range of 30. They are given in increasing order.

$$a, 8, 14, b, 26, c$$

Find the value of a, the value of b, **and** the value of c.

Question 4

Mikhail has €25 made up of 20 cent coins and 50 cent coins. He has 104 coins in total. Find the number of each type of coin Mikhail has.
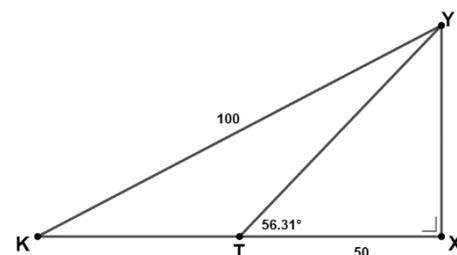
Round 6

Question 1

A sum of money was invested at compound interest for two years. The interest rate for each year was 5%. After the two years the sum amounted to €5512· 50. Calculate the original sum of money invested.
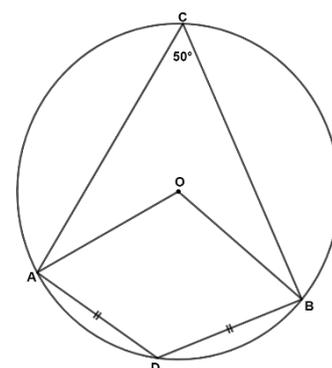
Question 2

A vertical mast [XY] stands on level ground. A straight wire joins Y, the top of the mast, to T, a point on the ground. T is 50 m from X, the bottom of the mast and $|\angle XTY| = 56.31°$. A second straight wire joins Y to K, another point on the ground. If the length of this wire is 100 m, find $|\angle YKX|$, correct to the nearest degree.
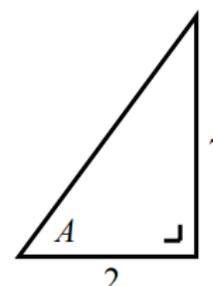

Question 3

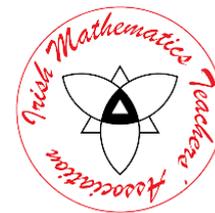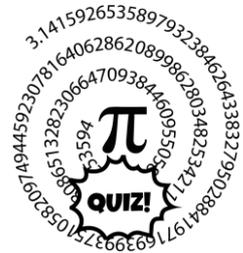A, D, B, C are points on a circle, as shown. O is the centre of the circle.

Given that $|\angle ACB|$ = 50° and $|AD|$ = $|DB|$, find $|\angle OAD|$.

Question 4

From the given triangle, find $cos\ A$ in surd form.
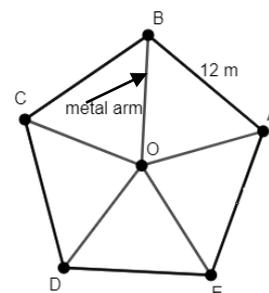
Round 7

Question 1

An estate agent's fee for selling a house is €13,500. This fee is 3% of the selling price of the house. Calculate the selling price.

Question 2

A box is in the shape of a cube of side 7 cm. Taking $\pi = \dfrac{22}{7}$, find the volume of the largest sphere which will fit exactly in the box, correct to 2 decimal places.

Question 3

Part of the winding mechanism of a crane is shown. The shape of the winding mechanism is a regular pentagon, with each outside length measuring $12\ m$ from corner to corner, as shown. The winding mechanism has 5 metal arms, each of which is connected to the centre of the mechanism, O and to the corner of the pentagon.
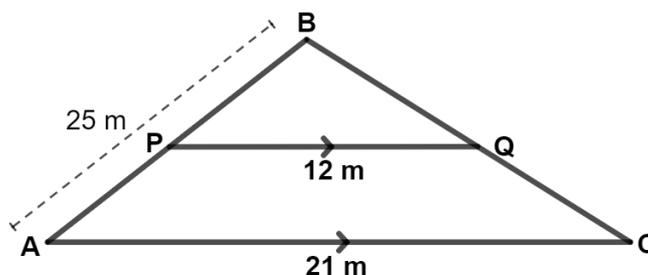
What is the total length of all 5 metal arms? (answer correct to nearest metre).
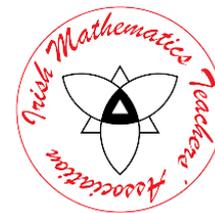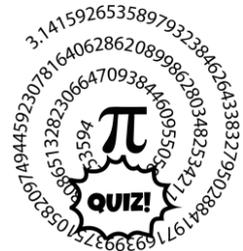
Question 4

Lines PQ and AC are parallel to each other.

$|PQ| = 12\ m$ and $|AC| = 21\ m$.
$|AB| = 25\ m$. Find the length of BP, in metres, correct to 1 decimal place.

Round 8

Question 1

A quadratic equation, $ax^2 + bx + c = 0$, has solutions of $\frac{1}{3}$ and $\frac{-2}{7}$. Find the values of the integers a, b and c.

Question 2

There is a total of 45 boys and girls in a choir. The mean age of the 18 boys is 16.2 years. The mean age of the 27 girls is 16.7 years. Calculate the mean age of all 45 boys and girls.

Question 3

The first level of a dollhouse is in the shape of a rectangle. Its floor plan is shown in the diagram. Both the toilet and the kitchen are square with areas of $400\ cm^2$ and $2500\ cm^2$, respectively. The living room is rectangular with an area of $3000\ cm^2$. Calculate the area of the rectangular storage room, in cm^2.

Question 4

Water flows through a cylindrical pipe of internal diameter 1 cm at a speed of 2 cm per second. What is the rate of flow of the water in cm^3 per second, taking $\pi = \frac{22}{7}$. Give your answer as a fraction in its simplest form.
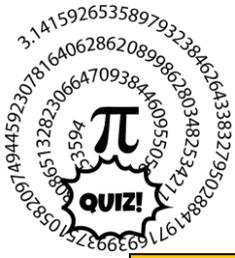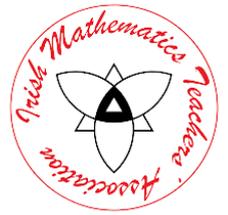
Answers

| Round 1	
1	$3 \div 6 \times 10 + 8 = 13$
2	400 **(minutes not required)**
Round 2	
1	$x = 3$ & $y = 4$
2	5 and 11 **(any order ok)**
Round 3	
1	37.5° **(° not required)**
2	5050
Round 4	
1	$312,000\ m$ **(units not required)**
2	$x = -\dfrac{5}{2}$
Round 5	
1	$y = x - 1$
2	€1805·44 **(€ not required)**
3	$a = 7, b = 16, c = 37$
4	90 twenty cent coins & 14 fifty cent coins
Round 6	
1	€5000
2	49° **(° not required)**
3	65° **(° not required)**
4	$\dfrac{2}{\sqrt{53}}$
Round 7	
1	€450,000 **(€ not required)**
2	$179.67\ cm^3$ **(units required)**
3	$51m$ **(units not required)**
4	$14.3\ m$ **(units not required)**
Round 8	
1	$a = 21, b = -1, c = -2$
2	16.5
3	$1800\ cm^2$ **(units not required)**
4	$\dfrac{11}{7}\ cm^3/sec$ **(units not required)**

Regional Round 2023
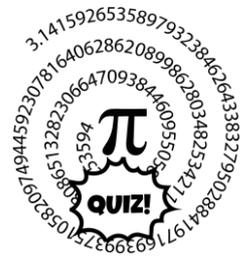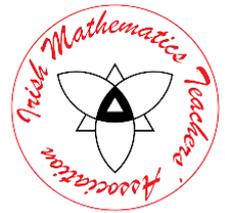
Tie Break

1	A solid cylinder, made of lead, has a diameter of $8\ cm$ and a height of $10\ cm$. Find the volume of the cylinder correct to 3 decimal places.
2	The length of a rectangle is three times its width. The area of the rectangle is $48\ cm^2$. Calculate the length of the rectangle.
3	Solve the equation $3x^2 + 10x - 8 = 0$
4	The distance between two points $(2t, 0)$ and $(0, -t)$ is $\sqrt{20}$. Find two values for t.
5	$k\left(2 + \sqrt{3}\right)\left(2 - \sqrt{3}\right) = 1$. Find the value of k.
6	A group of 20 people are attending a dinner party. Each person shakes hands with every other person exactly once. How many handshakes take place at the party?
7	The area of the given triangle is $121.5\ sq\ units$. Find the length of the hypotenuse.
8	Find an expression for the general term of the quadratic sequence $4, 6, 10, 16, 24, 34, \ldots$ Answer in the form $an^2 + bn + c$ where $a, b, c \in Z$.
9	An investment of €75,000 is worth €110,200 after 5 years at $x\%$ compound interest. Find the value of x, correct to the nearest percent.
10	Water flows through a cylindrical pipe, of diameter 10cm, at a rate of 14cm per second. How much water flows out of the pipe in one second? Take $\pi = \dfrac{22}{7}$
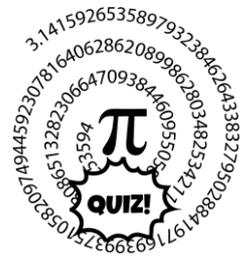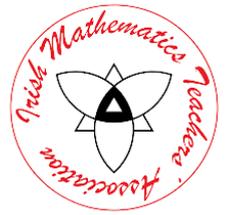
Answers to Tie Break

1. $502.655 \ cm^3$

2. $12 \ cm$

3. $\frac{2}{3} \ \& \ -4$

4. ± 2

5. 1

6. 190

7. $22.5 \ units$

8. $n^2 - n + 4$

9. 8%

10. $1100 \ cm^3$