UKMT

United Kingdom
Mathematics Trust

TEAM MATHS
CHALLENGE
2019

NATIONAL FINAL

SHUTTLE

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A1

As marked in the diagram below, $AG = AB$, $GB = BC, CD = CF, DF = FE$ and $\angle BAG = 52°$.
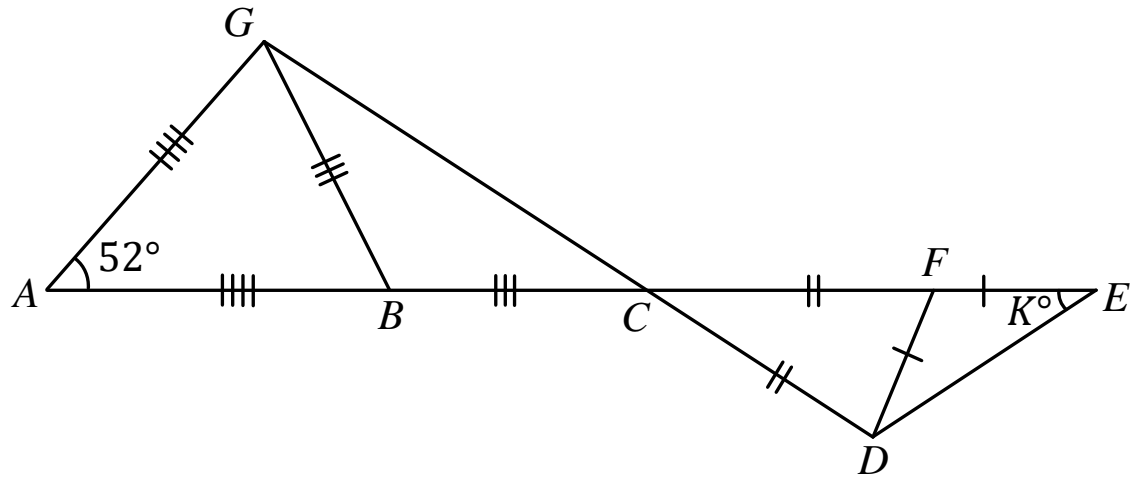
Angle $FED = K°$. Pass on the *sum of the digits* of K.
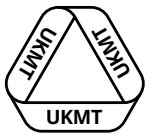
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A3

T is the number you will receive.

$$K = T \times \frac{\text{HCF}(105, T)}{\text{HCF}(125, T)} \times \frac{\text{LCM}(105, T)}{\text{LCM}(125, T)}$$

Pass on the value of K.

Note: HCF(a, b) means "the highest common factor of a and b", and LCM(a, b) means "the lowest common multiple of a and b".
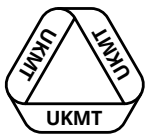
A2

The two shaded regions below have equal areas.
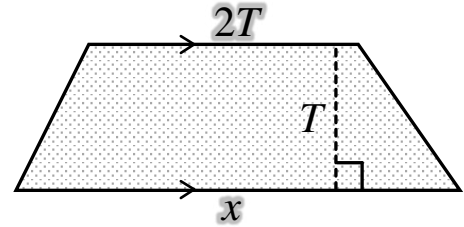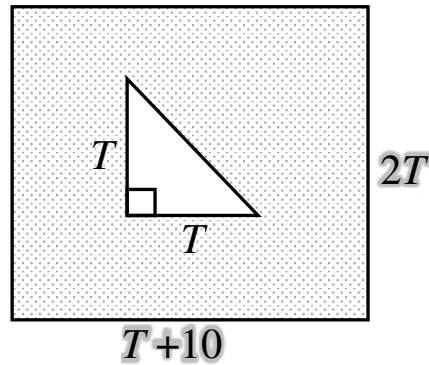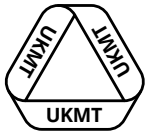

Pass on the value of x.
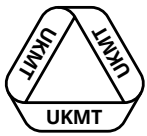
A4

A is the two-digit square whose digits add to 10.

B is the three-digit cube whose digits add to 10.

C is the two-digit Fibonacci number whose digits add to 10.
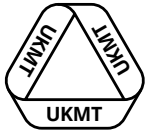
Write down the value of $\dfrac{A + B + C}{T}$.

B1

$$\frac{1}{2} \times \left(\frac{2}{3} - \frac{3}{4} \div \frac{4}{5} + \frac{5}{6} \right) = \frac{a}{b}$$

where $\frac{a}{b}$ is a fraction in its lowest terms.
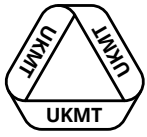
Pass on the value of a.

B3

T is the number you will receive.

Rectangle A has length T times its width.

Square B has perimeter T times the perimeter of rectangle A.

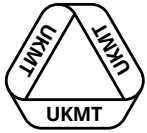The ratio of the area of A to the area of B is $1 : K$.

Pass on the value of K.

B2

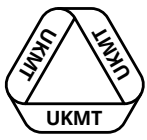*T is the number you will receive.*

$$T(y - 2) + 2y = \sqrt{T}(3y - 4)$$

Pass on the value of y.

B4

T is the number you will receive.

An N-sided regular polygon has exterior angles that are $T°$ greater than the exterior angles of an $(N + 1)$-sided regular polygon.
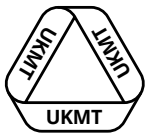
Write down the value of N.

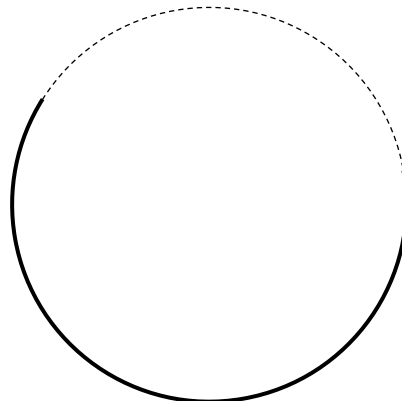Triangle ABC has lengths as marked. Its area is $84\,\text{cm}^2$ and its perimeter is K cm.
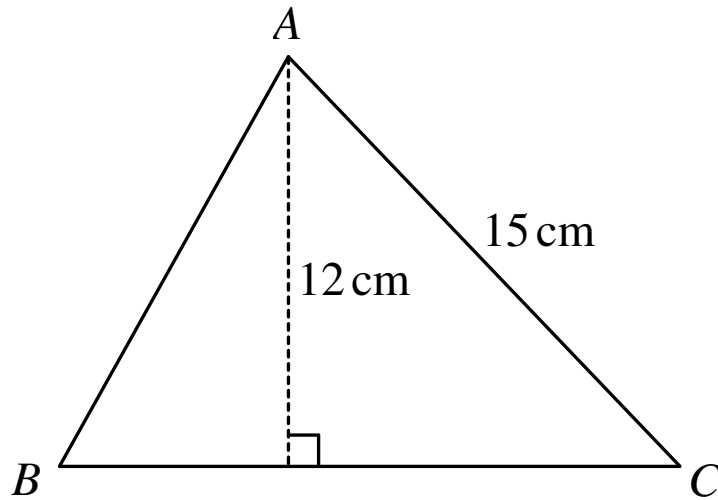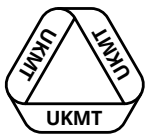

Pass on the *product* of the digits of K.

T is the number you will receive.

Astra has a circular wire hoop of radius 6 cm. She cuts it so that only $\frac{T}{360}$ of the hoop remains, and then bends this to form a new circle of radius r cm.
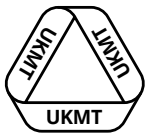

Pass on the value of r.

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C2

T is the number you will receive.

Masha is painting spherical rocks of radius 6 cm for her school play.

She has a cylinder full of paint, with base radius 6 cm and height T cm.

Every $1 \, \text{cm}^3$ of paint can cover $120 \, \text{cm}^2$ of surface area.

Masha is very careful and does not spill any paint.
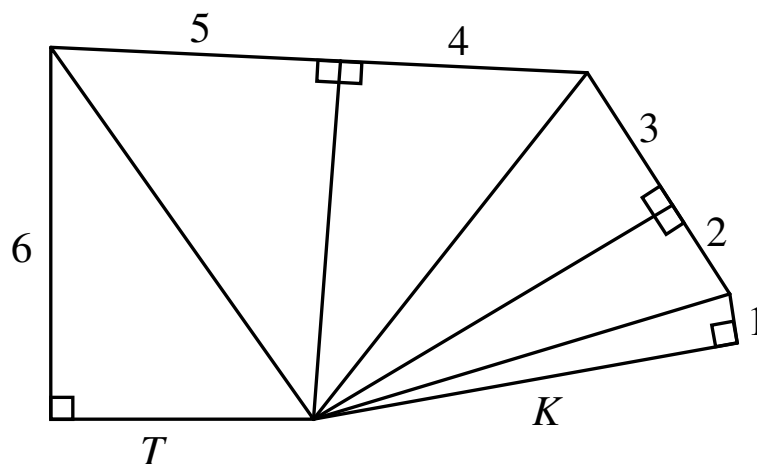
Pass on the number of rocks that Masha will be able to paint completely.

Note: The surface area of a sphere of radius r is $4\pi r^2$.

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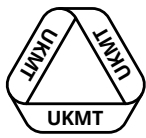TEAM MATHS
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C4

T is the number you will receive.

The diagram shows a sequence of right-angled triangles with side lengths as marked.
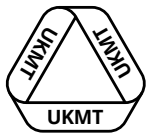

Write down the value of K^2.

The notation "♠(number)" means "multiply the first digit of the number by the number in reverse".

For example:

$$♠(56) = 5 \times 65 = 325$$
$$♠(281) = 2 \times 182 = 364$$
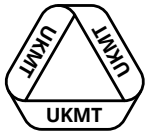$$♠(4) = 4 \times 4 = 16$$

Pass on the value of $♠(♠(♠(7)))$.

T is the number you will receive.

The Mathsland Highways Agency has adopted a new logo.

It is a square of side T, where E divides AD in the ratio 2 : 1, F divides AB in the ratio 2 : 3, and G divides BC in the ratio 1 : 4.
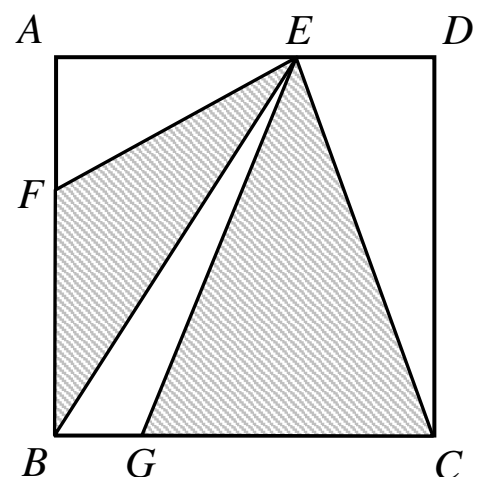
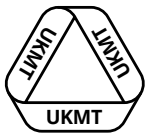Pass on the area of the shaded region.

T is the number you will receive.

$$10X + 1 = \frac{T+1}{4} - \frac{T+1}{5}$$

Pass on the value of X.

T is the number you will receive.

Wei Wei is a wayward child, who likes to run along the moving walkway at the airport.

The walkway is T metres long, and moves at 2 metres per second.

Running in the same direction as the walkway means Wei Wei completes it 20 seconds quicker than running along the walkway the other way.

Wei Wei runs at W metres per second. Write down the value of W.

SHUTTLE RESPONSE SHEET

TEAM NUMBER [ ]   SCHOOL NAME [ ]

> Mark the answers only when you are given **all four answers**, or at the end of the round.
> **Stop marking when an answer is wrong.** If the round hasn't ended, hand the ANSWER SHEET back for correction.

A1 ⓪①③	B1 ⓪①③	C1 ⓪①③	D1 ⓪①③
A2 ⓪①③	B2 ⓪①③	C2 ⓪①③	D2 ⓪①③
A3 ⓪①③	B3 ⓪①③	C3 ⓪①③	D3 ⓪①③
A4 ⓪①③	B4 ⓪①③	C4 ⓪①③	D4 ⓪①③

BONUS ③   BONUS ③   BONUS ③   BONUS ③

A TOTAL /15 [ ]   B TOTAL /15 [ ]   C TOTAL /15 [ ]   D TOTAL /15 [ ]

> Circle the mark awarded for each question and cross out the others.
> At the end of the round, either circle the bonus mark or cross it out.

FINAL SCORE /60 [ ]