

A1

$$\text{Let } \frac{1}{x} + \frac{1}{6} + \frac{1}{x+8} = \frac{1}{2} \quad \text{where } x > 0.$$

Pass on the value of x .



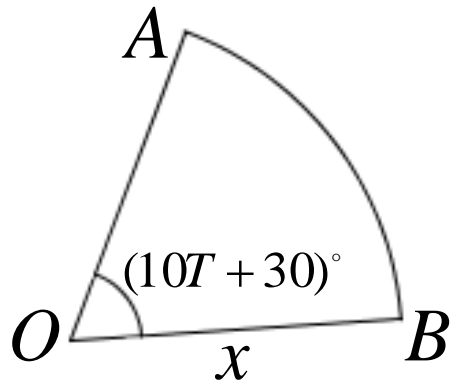
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National Final 2010
Mini Relay Round



A2 *T* is the number that you will receive.

A circle has radius x cm and centre O .

A and B are points on the circumference such that $\angle AOB = (10T + 30)^\circ$ as shown. Find the value of x if the area of the sector AOB is 28π cm².

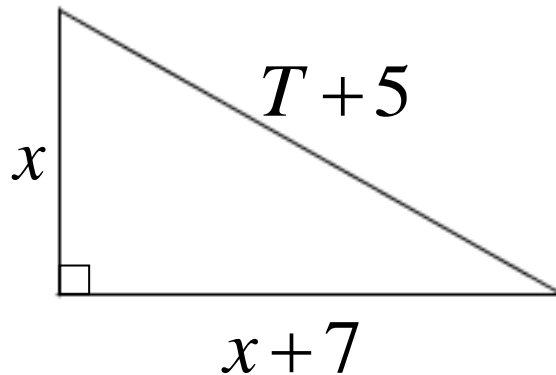


Pass on the value of x .



A3 *T is the number that you will receive.*

The right angled triangle shown has hypotenuse of length $(T + 5)$ cm and two shorter sides of length x cm and $(x + 7)$ cm. Find the value of x .

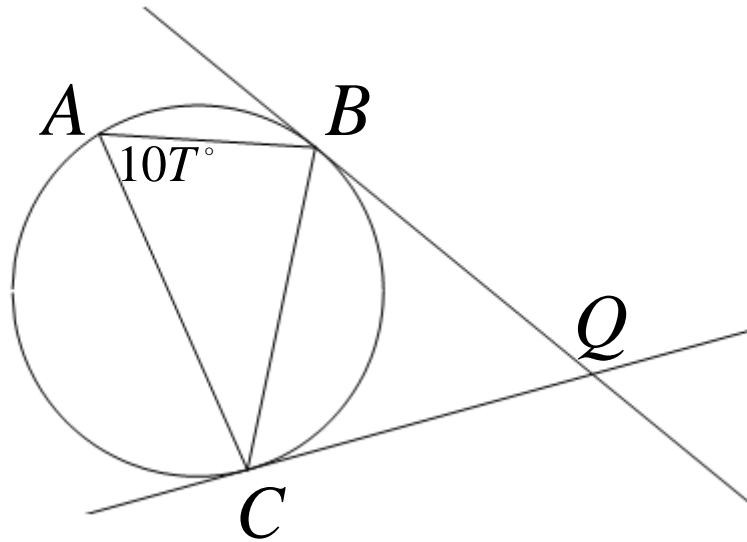


Pass on the value of x .



A4 *T* is the number that you will receive.

In the diagram shown, BQ and CQ are tangents to the circle and $\angle CAB = 10T^\circ$.



Find, in degrees, the size of $\angle BQC$.



B1

Simplify $\sqrt{20} + 2\sqrt{45} - \sqrt{80} - 9\left(\frac{8}{27}\right)^{\frac{2}{3}}$

Write your answer in form $a(\sqrt{b} - c)$ where a , b and c are integers and b has no square factors.

Pass on the value of a .



B2 T is the number that you will receive.

Line p passes through points $(T - 1, 9)$ and $(2T, 5)$. Line q is perpendicular to line p .

The gradient of p is A and the gradient of q is B .

Pass on the value of $20(A + B)$.



B3 *T is the number that you will receive.*

Simplify $\frac{T-6}{\sqrt[4]{x}} \times Tx^{\frac{2}{3}} \div \left(\frac{1}{3}Tx^{\frac{1}{6}} \right)$

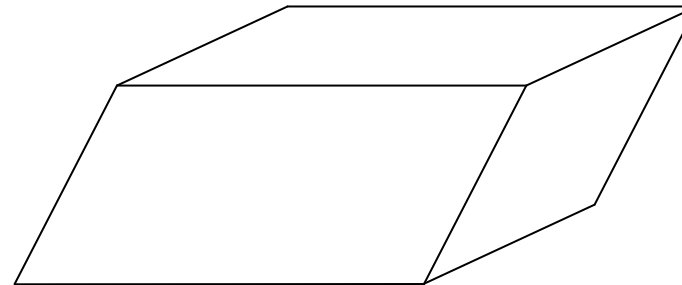
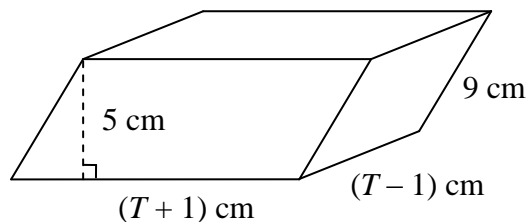
Write your answer in the form ax^b .

Pass on the value of $4ab$.



B4 *T is the number that you will receive.*

Two similar parallelepipeds, with four rectangular faces each, have volumes in the ratio 1:64.



Find the total surface area of the larger parallelepiped.



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C1

How many distinct four-digit numbers can be formed by different arrangements of the digits 2, 3, 3, and 5?

Pass on the number of arrangements.



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C2 *T is the number that you will receive.*

The mean of the grouped data shown below in the frequency table is a .

x cm	Frequency
2	6
4	$T - 6$
6	$T - 2$
$T - 3$	12

Pass on the value of a .



C3 *T is the number that you will receive.*

A sphere of radius T cm has the same volume as a cylinder of radius 4 cm and height h cm.

Pass on the value of h .



C4 *T is the number that you will receive.*

A bag contains $\frac{T}{3}$ red counters and $(T - 11)$ blue counters. Two counters are withdrawn without replacement. Find the probability that both counters are red. Put your answer in the form $\frac{a}{b}$, where a and b have no common factor greater than 1.

Write down the value of $b - a$.



D1

Simplify the following:

$$\frac{7x^2 + 14x - 21}{3x^2 + 2x - 5} \times \frac{3x^2 - 7x - 20}{x^2 - x - 12}$$

Pass on your answer.



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D2 *T is the number that you will receive.*

Pass on the solution to the equation $729^{T-3} = 3^{5x-1}$.



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D3 *T is the number that you will receive.*

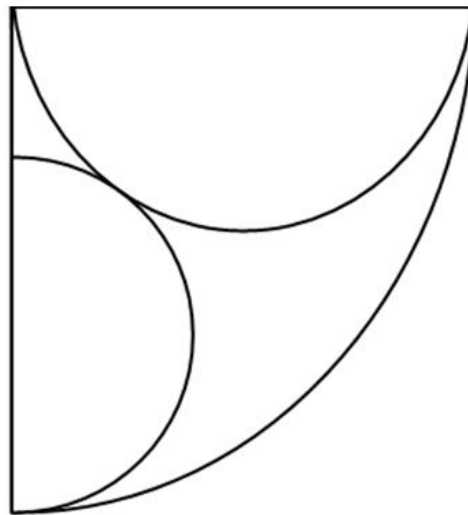
Write $\frac{T-3}{3-\sqrt{7}}$ in the form $\sqrt{a} + b$.

Pass on the value of $3b - a$.



D4 *T* is the number that you will receive.

In the diagram below, the diameter of the larger semicircle and the radius of the quadrant are both T cm.



Find the radius, in cm, of the smaller semicircle.



E1

Consider the five expressions: \sqrt{x} , x^2 , $\frac{1}{\sqrt{x}}$, x^3 , $2x$

Given that $1 < x < 2$, arrange these expressions in ascending order of magnitude, identify the middle term, and put it in the form ax^b .

Pass on the value of $3b$.



E2 *T is the number that you will receive.*

Find the mean of the following: $\frac{T-5}{3}$, $\frac{1}{2}$, $\frac{1}{6}$, $\frac{1}{4}$

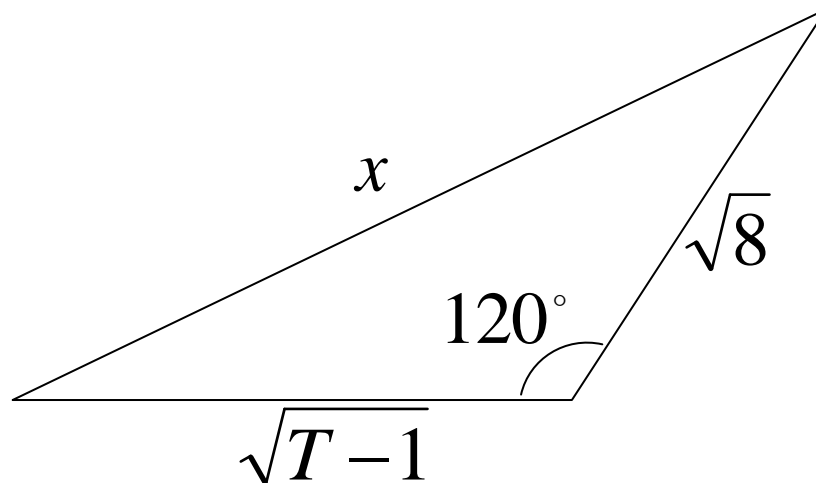
Your answer should be in the form $\frac{a}{b}$, where a and b have no common factor greater than 1.

Pass on the value of $\frac{a+b}{7}$.



E3 *T is the number that you will receive.*

Consider the following triangle:



Pass on the value of $x^2 - 2$.



E4 *T is the number that you will receive.*

The area of a given shape is calculated by one of the following formulae. The area of the shape is T^2 , with x and y positive integers and $x > y$.

$$A = \frac{7x^2y^2}{x+y}$$

$$A = \frac{x^2}{2} + 2\pi y$$

$$A = 3xy^2 + 3x^2y$$

$$A = x(y-x) + y(x-y) - 2xy$$

Find the value of x .



F1

Solve the equation $\left(\frac{1}{4}\right)^{x-3} = 8^{x-8}$.

Pass on the value of x .



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F2 *T is the number that you will receive.*

Liz is buying tins of dog food for her pet corgis. She knows that if each tin lasts for $(T - 3)$ days, her supply will last for $(x + 3T)$ days whereas if each tin lasts for $(T - 4)$ days, her supply will last for $2x - 4$ days.

Pass on the value of x .



F3 *T is the number that you will receive.*

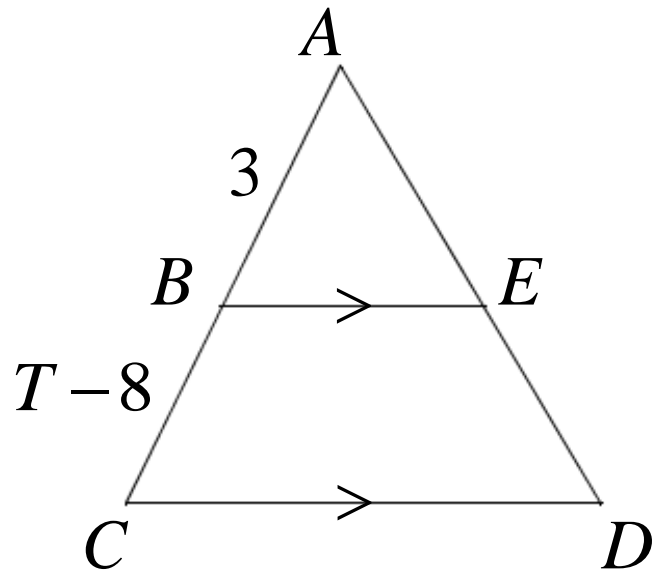
The equation $2x^2 + (1 - 2T)x - T = 0$ has two solutions, $x = a$ and $x = b$, with $a > b$.

Pass on the value of $a - 4b$.



F4 *T is the number that you will receive.*

In the diagram below, triangles ABE and ACD are similar. Write down the ratio of the area of trapezium $BCDE$ to the area of triangle ABE in the form $p:q$ where p and q have no common factor greater than 1.



Write down the value of $p + q$.

