

**A1** The value of  $\frac{\sqrt{2}+1}{\sqrt{2}+2}$  can be expressed as  $k\sqrt{2}$  .

Calculate the value of  $6k$ .



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

Given that  $x = \frac{T + \frac{1}{T}}{T - \frac{1}{T}}$  and  $y = \frac{x + \frac{1}{x}}{x - \frac{1}{x}}$  calculate the value of  $9y$ .

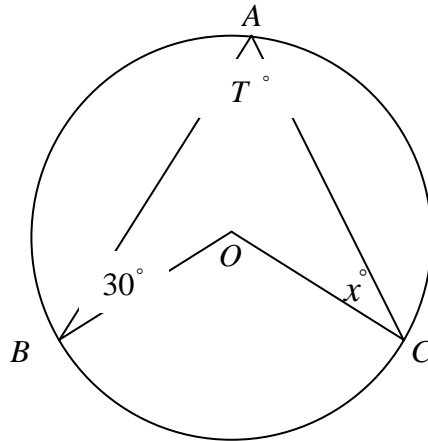


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### **A3** *T is the number that you will receive*

In the diagram below,  $O$  is the centre of the circle,  $\angle BAC = T^\circ$ ,  $\angle ABO = 30^\circ$  and  $\angle ACO = x^\circ$ . Calculate the value of  $x$ .



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

Calculate the length of the line segment joining the points with coordinates  $(T,5)$  and  $(3,T)$ .



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**B1** Two cuboids have edge lengths which are integer numbers of centimetres. The cuboids have the same volume  $6\text{cm}^3$  but different surface areas.

Calculate the sum of the surface areas of the two cuboids.



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**B2** *T is the number that you will receive*

Given that  $9^{\frac{T}{6}} = 3^{2x-8}$ , calculate the value of  $x$ .



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

Calculate the value of  $\frac{(x^2 + 4x - 5)(x^2 - x - T)}{(x - 1)(x^2 + 8x + 15)}$  when  $x = 28$ .



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

Every person in a group of  $T$  people can juggle or play the piano or do both. The number of people that can't play the piano is three times the number of people that can do both and the number of people that can't juggle is four times the number of people that can do both.

How many people can do both?



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**C1** Let  $a \oplus b$  denote the lowest common multiple of  $a$  and  $b$  and let  $a \otimes b$  denote the highest common factor of  $a$  and  $b$ .

Calculate the value of  $(135 \otimes 255) \oplus (156 \otimes 228)$



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

The quadratic equations  $x^2 - 16x + T = 0$  and  $x^2 - Tx + 324 = 0$  have a root in common. What is the common root?



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

*a, b and c* satisfy the simultaneous equations:

$$a + b - c = T - 8$$

$$a - b + c = 0$$

$$-a + b + c = T + 2$$

Calculate the value of  $a^2 + b^2 + c^2$ .



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

On a table is a prism with a cross-section which is a regular polygon with  $T$  sides. Lying next to it is a pyramid whose base is also a regular polygon with  $T$  sides.

Calculate the value of:

*Total number of vertices + Total number of edges + Total number of faces.*



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