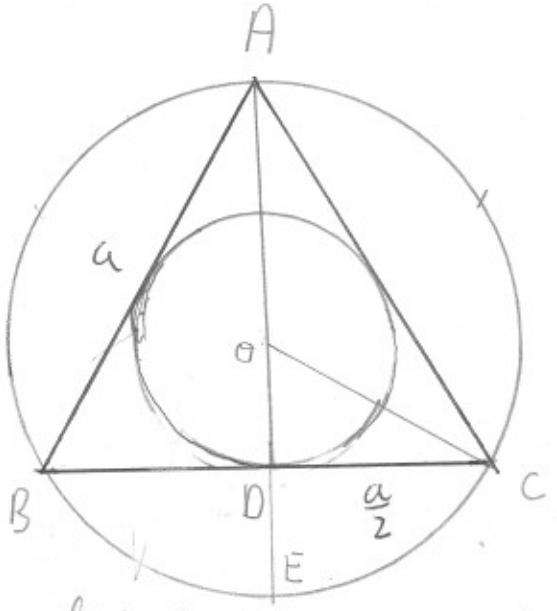
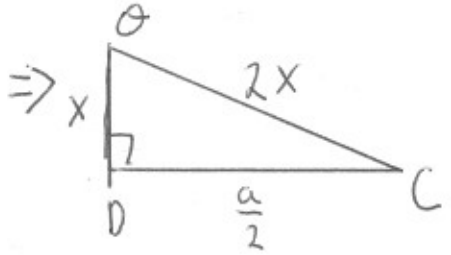
Level 2 Part 1



1) AD an altitude. Hence an angle bisector.

2 Arc EC subtends $\measuredangle EAC$ a central $\measuredangle EOC$.
So $\measuredangle EOC = 2(\measuredangle EAC) = 60°$. Thus ΔODC is a 30-60-90 triangle. Side DC has length $= \frac{a}{2}$
So side OC has length = 2 length OD = 2x



$$x^2 + \frac{a^2}{4} = 4x^2$$

$$4x^2 + a^2 = 16x^2 \Rightarrow 12x^2 = a^2 \Rightarrow x = \frac{a}{\sqrt{12}} = \frac{\sqrt{3}\,a}{6}$$

So the radius of the inner circle $= \frac{\sqrt{3}\,a}{6}$
" " " outer circle $= 2\left(\frac{\sqrt{3}\,a}{6}\right)$

1 a) Area inner circle $= \pi\left(\frac{\sqrt{3}a}{6}\right) = \pi\left(\frac{3a^2}{36}\right) = \frac{a^2\pi}{12}$

1 b) $\frac{\pi r^2}{\pi(2r)^2} = \frac{\pi r^2}{4\pi r^2} = \frac{1}{4}$

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Table 1: How many? See question 2.

#2

Dimensions	1×1	1×2	1×3	1×4	2×2	2×3	2×4	3×3	3×4	Total
	15	21	13	5	7	8	3	2	1	75

3) $3x + \alpha y = 6$ (i) Multiply (i) by $-\frac{\beta}{3}$

$\beta x + 4y = 7$ (ii)

$-\beta x - \frac{\beta\alpha}{3} y = -2\beta$ (i') Add (i') to (ii)

$\beta x + 4y = 7$ (ii)

$\left(4 - \frac{\beta\alpha}{3}\right) y = 7 - 2\beta$. For the solution to be unique, we need $4 - \frac{\beta\alpha}{3} \neq 0$ or $\alpha\beta \neq 12$. Then

$$y = \frac{21 - 6\beta}{12 - \alpha\beta}$$

$$x = \frac{6 - \alpha y}{3} = 2 - \frac{\alpha(7 - 2\beta)}{12 - \alpha\beta} = \frac{24 - 2\alpha\beta - 7\alpha + 2\alpha\beta}{12 - \alpha\beta}$$

$= \frac{24 - 7\alpha}{12 - \alpha\beta}$. Note values of x & y were not needed in the sol'n.

4)

$x = 2n+1,\ x+2,\ x+4,\ x+6,\ x+8,\ x+10,\ x+12$

$$37 = \frac{x + x+2 + x+4 + x+6 + x+8 + x+10 + x+12}{7} \Rightarrow$$

$7 \cdot 37 = 7x + 42 \Rightarrow 7x = 7 \cdot 37 - 42$

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$x = 37 - 6 = 31$

a) $\sqrt[7]{31 \cdot 33 \cdot 35 \cdot 37 \cdot 39 \cdot 41 \cdot 43} = 36.7822$

b) $\dfrac{7}{\frac{1}{31} + \frac{1}{33} + \frac{1}{35} + \frac{1}{37} + \frac{1}{39} + \frac{1}{41} + \frac{1}{43}} = 36.5637$

5) $x \rightarrow 2x \rightarrow 2x+12 \rightarrow x+6 \rightarrow x+6-x \rightarrow 6$