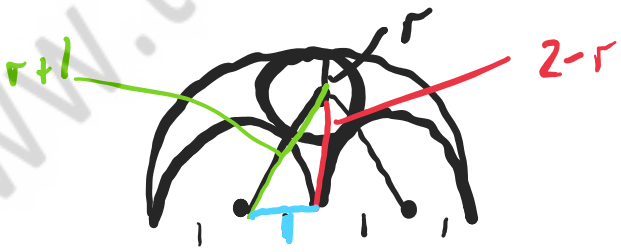
Eton 2017 King's Scholarship B Solutions

1) a) Expand brackets
   b) i) 1009, 1008
   ii) 10086009, 10086008
   c) Any odd number = 2k+1 (some k) so is the difference of $(k+1)^2$ and k^2 by part a.
   d) $(k+2)^2 - k^2 = 4k + 4.$
   505 and 503.
   e) No – it only works for multiples of 4
2) a) 2:3
   b) 5:8
   c) 3
   d) 28 and 36
3) a) Expand.
   b) $x^2 + y^2 = (x+y)^2 - 2xy = 96$
   c) $x^2y + y^2x = xy(x+y) = 2 \times 10 = 20$
   d) $(x+y)(x^2+y^2) = x^3 + x^2y + xy^2 + y^3$
   e) $x^3 + y^3 = (x+y)(x^2+y^2) - x^2y - xy^2 = 10 \times 96 - 20 = 940$
4) a) 10.3s
   b) 24.9s
   c) 0.588 minutes
5) a) $\frac{2}{3}cm^2$
   b) $1.5cm^2$
   c) $2.5cm^2$
6) a) 300 gradians
   b) 63 degrees
   c) 72 degrees
   d) 73 gradians
7) a) 5cm
   b) Pythagoras
   c) i)



   From part b): $2 - r = \sqrt{(r+1)^2 - 1}$ and hence result.
   ii) $2 - r = \sqrt{(r+1)^2 - 1}$
   Square both sides for: $4 - 4r + r^2 = r^2 + 2r + 1 - 1$
   $6r = 4$
   $r = \frac{2}{3}$
8) a) $x = ab, \{x\} = ba$
   $x = 10a + b \; so \; a = \frac{x-b}{10}$

$\{x\} = 10b + a \; so \; a = \{x\} - 10b$

Putting the two together: $\frac{x-b}{10} = \{x\} - 10b$ and hence result.

b) $y = 100a + 10b + c$

$\{y\} = 100c + 10a + b$

$10\{y\} = 1000c + 100a + 10b$

Third equation – first equation: $10\{y\} - y = 999c$

$\{y\} = \frac{999c+y}{10}$

c) a b c d e 9

x 4

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9 a b c d e

9 x 4 = 36 so e=6 and fill both e's.

Continue the multiplication from the RHS as usual, filling in d then c then b then a.

z = 230769