**GCSE 7+ Session 5**
**Independent Practice**
**Lines and Circles**
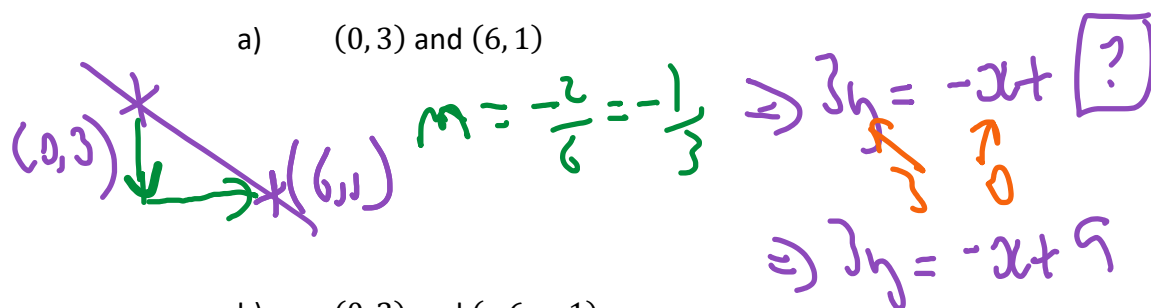
KING'S
MATHS
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*Revise, refresh, recall* the core knowledge and skills:

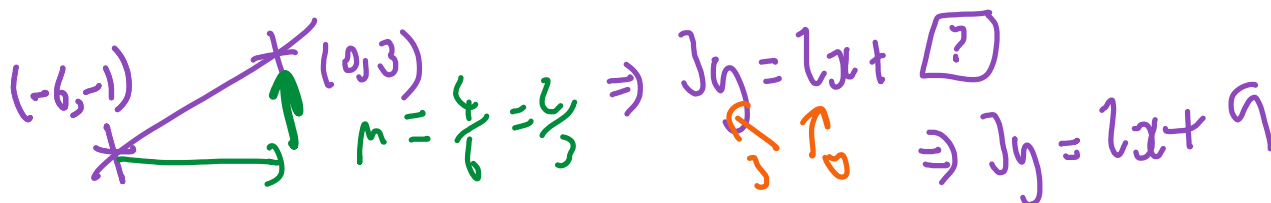1    Copy and complete this table, filling in the empty cells. The first row is an example.

| Equation of line | $y$-intercept | gradient | $x$-intercept |
|---|---|---|---|
| $y = 4x - 7$ | $(0, -7)$ | $4$ | $\left(1\frac{3}{4}, 0\right)$ |
| $5y = 2x - 4$ | $\left(0, \frac{-4}{5}\right)$ | $2/5$ | $(2, 0)$ |
| $4y + x + 6 = 0$ | $\left(0, -1\frac{1}{2}\right)$ | $-1/4$ | $(-6, 0)$ |
| $y = 2x - 3$ | $(0, -3)$ | $2$ | $\left(1\frac{1}{2}, 0\right)$ |
| $y = 3$ | $(0, 3)$ | $0$ | $\times$ |
| $3y = 2x - 12$ | $(0, -4)$ | $\frac{2}{3}$ | $(6, 0)$ |
| $y = -3x + 6$ | $(0, 6)$ | $-3$ | $(2, 0)$ |
| $5y = -4x - 8$ | $\left(0, -1\frac{3}{5}\right)$ | $-\frac{4}{5}$ | $(-2, 0)$ |

2    Work out the equation of the lines joining

a)    $(0, 3)$ and $(6, 1)$

$(0,3)$ ↓ $(6,1)$    $m = \frac{-2}{6} = -\frac{1}{3} \Rightarrow 3y = -x + \boxed{?}$

$\Rightarrow 3y = -x + 9$

b)    $(0, 3)$ and $(-6, -1)$

$(-6,-1)$    $(0,3)$    $m = \frac{4}{6} = \frac{2}{3} \Rightarrow 3y = 2x + \boxed{?}$

$\Rightarrow 3y = 2x + 9$

c)    $(6, 3)$ and $(6, 1)$

$(6,3)$    $(6,1)$    $x = 3$ (vertical)
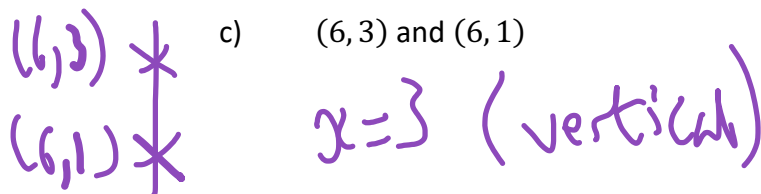
3    a)    Work out the co-ordinate(s) of any point(s) of intersection of
- the line $y = 10 - 3x$
- the circle with centre $(0, 0)$ and radius $2\sqrt{5}$

$x^2 + y^2 = (2\sqrt{5})^2$

$= 4 \times 5 = 20$

$[\text{not } 10]$

Solve simultaneously

$\left.\begin{array}{l} y = 10 - 3x \\ x^2 + y^2 = 20 \end{array}\right\} \Rightarrow x^2 + (10 - 3x)^2 = 20$
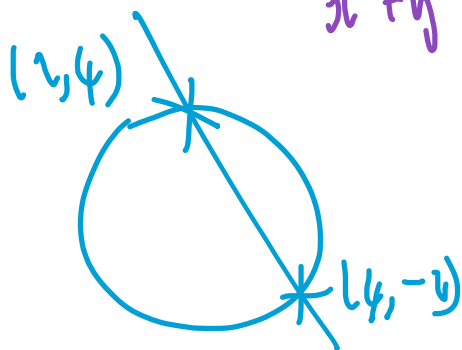
$\Rightarrow x^2 + 100 - 60x + 9x^2 = 20$

$\Rightarrow 10x^2 - 60x + 80 = 0$

$\Rightarrow x^2 - 6x + 8 = 0$

$\Rightarrow (x - 2)(x - 4) = 0$

$\Rightarrow x = 2 \text{ or } x = 4$

$x = 2, y = 4$ ✓    $y = 10 - 3x$

$\searrow x = 4, y = -2$ ✓

$(2, 4)$

$(4, -2)$



b)    Repeat, for the same circle but now with the line $y = 10 - 2x$.

What do you notice?

$\left.\begin{array}{l} y = 10 - 2x \\ x^2 + y^2 = 20 \end{array}\right. \Rightarrow x^2 + (10 - 2x)^2 = 20$

$\Rightarrow x^2 + 100 - 40x + 4x^2 = 20$

$\Rightarrow 5x^2 - 40x + 80 = 0$

$\Rightarrow x^2 - 8x + 16 = 0$

$\Rightarrow (x - 4)(x - 4) = 0$

$\Rightarrow x = 4 \text{ (only one root)}$

$\Rightarrow y = 2 \quad [y = 10 - 2x]$

$\Rightarrow$ line is a tangent

$(4, 2)$