3055 BA SANGAM COLLEGE

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WORKSHEET 16

School: **Ba Sangam College** **Year / Level:** **12**
Subject: **Mathematics** **Name of Student:** _______________

Strand	3 – Graphs
Sub strand	3.1 – Graphs and Intersections
Content Learning Outcome	➢ Interpret and solve simultaneous equations

Simultaneous Equations **(Ref: Year 12 Mathematics Pg 120 – 124)**

Applications of Simultaneous Equations – Points of Intersections

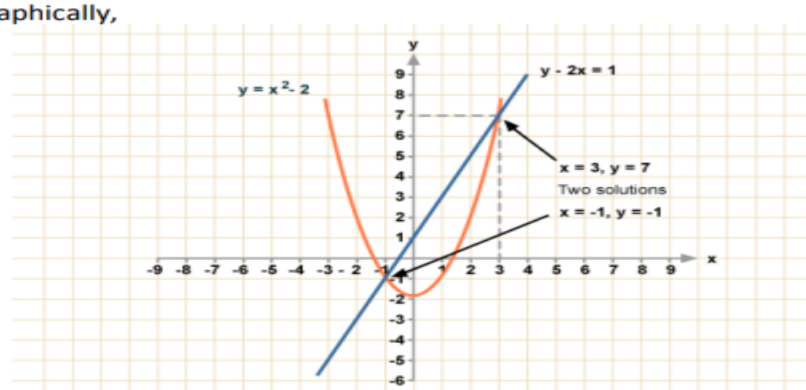
1. Linear and Quadratic Equation

> **Note:** Quadratic equation and straight line graphs will meet at, at most two places. The answers to be written in coordinate form: (x, y).
>
> You may be required to use factorization technique or quadratic formula.

EXAMPLE 1:

Find the coordinates of the points of intersection of the parabola $y = x^2 - 2$ **and the straight line** $y - 2x = 1$

Graphically,



Using **Substitution method:**

Substitute the first equation in the second one by replacing in place of y.

$y = x^2 - 2$

$\downarrow$

$y - 2x = 1$

$(x^2 - 2) - 2x = 1$ Collect all on one side, since it's a trinomial.

$x^2 - 3 - 2x = 0$ Rearrange from highest degree

$x^2 - 2x - 3 = 0$ Factorise

x −3
x 1

Thus $(x - 3)(x + 1) = 0$

$x = -1, 3$

Substitute the x value in any equation to solve for y:

If $x = -1$, $y = x^2 - 2 = (-1)^2 - 2 = -1$

If $x = 3$, $y = x^2 - 2 = (3)^2 - 2 = 7$

$\therefore (-1, -1)\ and\ (3, 7)$

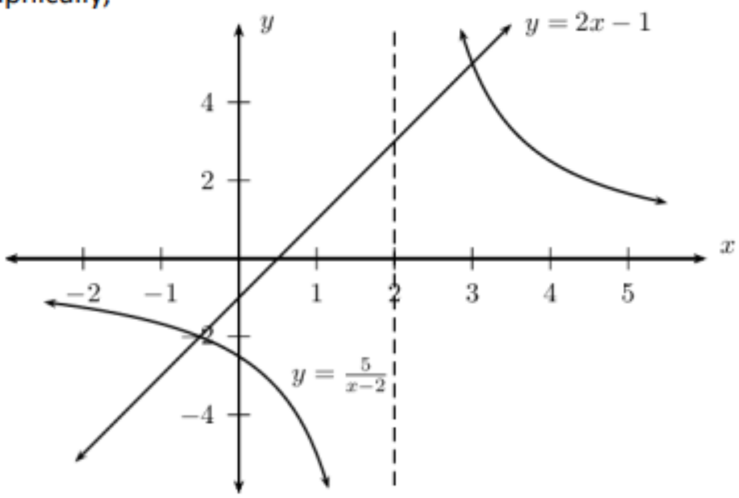
2. Linear and Hyperbolic Equation

Note: Hyperbolic equation and straight line graphs will meet at, at most two places.

EXAMPLE 1:

Find the coordinates of the points of intersection of the parabola $y = \frac{5}{x - 2}$ **and the straight line** $y = 2x - 1$

Graphically,



Using **Substitution method:**

Substitute the first equation in the second one by replacing in place of y.

$y = \frac{5}{x-2}$

$\downarrow$

$y = 2x - 1$

$2x - 1 = \frac{5}{x-2}$ Take denominator on the left side.

$(2x - 1)(x - 2) = 5$ Expand the brackets

$2x^2 - 4x - x + 2 = 5$ Collect all on one side, since it's a trinomial.

$-5 \quad -5$

$2x^2 - 5x - 3 = 0$ You may use quadratic formula.

a = 2, b = − 5, c = − 3

Substitute the values: $x = \frac{--5 \pm \sqrt{(-5)^2 - 4(2)(-3)}}{2(2)} = \frac{5 \pm \sqrt{25+24}}{4} = \frac{5 \pm \sqrt{49}}{4} = \frac{5 \pm 7}{4}$

➲ $= 3, -\frac{1}{2}$

Substitute the x value in any equation to solve for y:

If $x = 3$, $y = 2x - 1 = 2(3) - 1 = 5$
If $x = -½$, $y = 2x - 1 = 2(-½) - 1 = -2$
$\therefore (3,5) \ \& \ (-\frac{1}{2}, -2)$

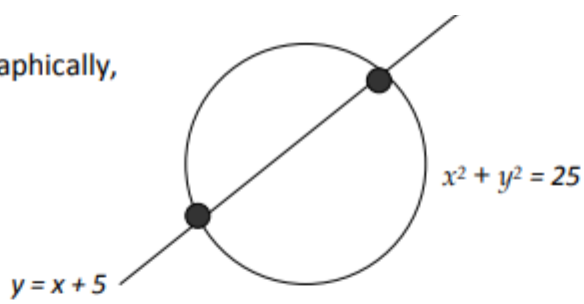
3. **Linear Equation and Circle**

Note: Circles and straight line graphs will meet at, at most two places. You may be required to use factorization technique or quadratic formula.

EXAMPLE 1:

Find the coordinates of the points of intersection for the equations $x^2 + y^2 = 25$ **and** $y = x + 5$

Graphically,



Using **Substitution method:**

Substitute the first equation in the second one by replacing in place of y.

$y = x + 5$

$x^2 + y^2 = 25$

$x^2 + (x + 5)^2 = 25$	Expand the brackets
$x^2 + (x^2 + 10x + 25) = 25$	
$2x^2 + 10x = 0$	Factorize
$2x(x + 5) = 0$	Solve
$x = -5, 0$	

Substitute the x value in any equation to solve for y:

If $x = 0$, $y = x + 5 = y = 0 + 5 = 5$

If $x = -5$, $y = x + 5 = y = -5 + 5 = 0$

$\therefore (0,5) and (-5,0)$

ACTIVITY **(4 marks each)**

1. Find the co-ordinates of the points of intersection of the line $y = 3x + 1$ with the parabola $y = x^2 - 3$.
2. Find the point of intersection of the curve $y = -\frac{2}{x}$ with the line $y = x - 3$.

3.

Find the coordinates of the points of intersection of the circle $x^2 + y^2 = 5$ and the straight line $y - x + 3 = 0$.

THE END