

## Intersection of Linear and Quadratic Functions

### Warm-up

Determine the point of intersection of the two lines  $y = -2x + 10$  and  $y = -x + 2$  using a variety of techniques.

$$(2x + y = 10)$$

( $x + y = 2$ )  
Elimination

$$\textcircled{1} 2x + y = 10$$

$$\textcircled{2} x + y = 2$$

$$\textcircled{1} - \textcircled{2} = \textcircled{3} x = 8$$

sub  $\textcircled{3}$  into  $\textcircled{2}$

$$(8) + y = 2$$

$$y = 2 - 8$$

$$y = -6$$

$\therefore$  The P.O.I. is  $(8, -6)$

\* Substitution

$$\textcircled{1} y = -2x + 10$$

$$\textcircled{2} x + y = 2$$

sub  $\textcircled{1}$  into  $\textcircled{2}$

$$x + (-2x + 10) = 2$$

$$x - 2x + 10 = 2$$

$$-x + 10 = 2$$

$$-x = 2 - 10$$

$$-x = -8$$

$$\frac{-x}{-1} = \frac{-8}{-1}$$

$$\textcircled{3} x = 8$$

sub  $\textcircled{3}$  into  $\textcircled{1}$

$$y = -2(8) + 10$$

$$y = -16 + 10$$

$$y = -6$$

$\therefore$  The P.O.I. is  $(8, -6)$

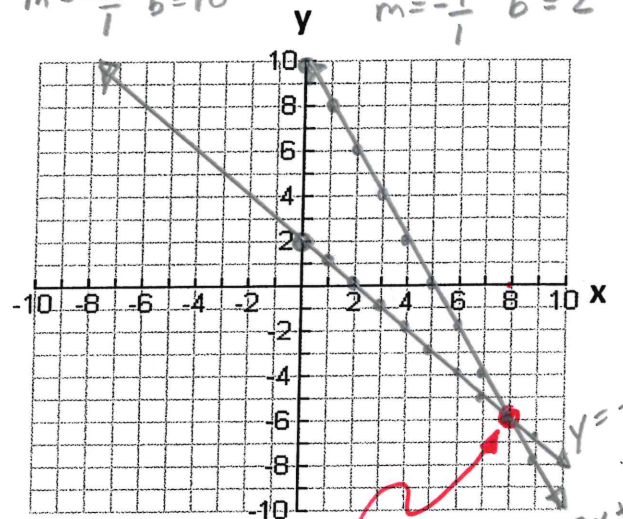
Graphing

$$y = -2x + 10$$

$$m = -\frac{2}{1} \quad b = 10$$

$$y = -x + 2$$

$$m = -\frac{1}{1} \quad b = 2$$



$\therefore$  P.O.I. is  $(8, -6)$

### Example 1

Determine the point(s) of intersection of the line  $y = 2x - 2$  and the parabola  $y = 2x^2 - 8x + 10$ .

$$\textcircled{1} y = 2x^2 - 8x + 10$$

$$\textcircled{2} y = 2x - 2$$

sub  $\textcircled{1}$  into  $\textcircled{2}$

$$(2x^2 - 8x + 10) = 2x - 2$$

$$2x^2 - 10x + 12 = 0$$

$$2(x^2 - 5x + 6) = 0$$

$$2(x - 2)(x - 3) = 0$$

$$x = 2 \text{ or } x = 3$$

sub  $x = 2$  into  $\textcircled{2}$

$$y = 2(2) - 2$$

$$y = 2$$

$\therefore$  P.O.I. @

$$(2, 2)$$

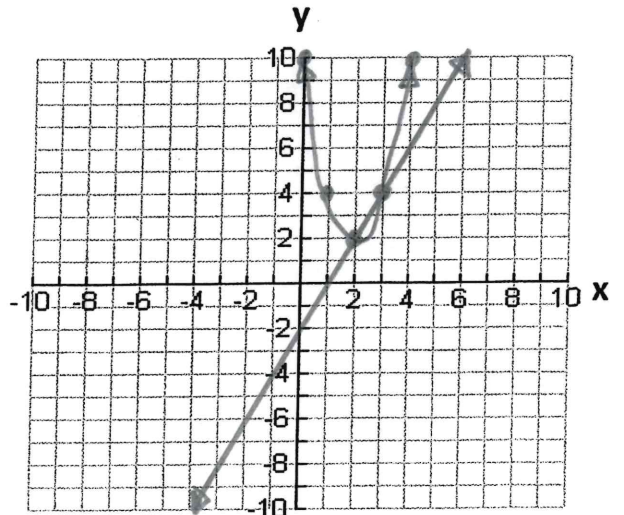
sub  $x = 3$  into  $\textcircled{2}$

$$y = 2(3) - 2$$

$$y = 4$$

$\therefore$  P.O.I. @

$$(3, 4)$$



### Example 2

Determine the point(s) of intersection of the line  $y = 4x - 14$  and the parabola  $y = -2x^2 + 12x - 22$ .

①  $y = 4x - 14$

②  $y = -2x^2 + 12x - 22$

Sub ① into ②

$$4x - 14 = -2x^2 + 12x - 22$$

$$2x^2 - 8x + 8 = 0$$

$$2(x^2 - 4x + 4) = 0$$

$$2(x - 2)(x - 2) = 0$$

③  $x = 2$

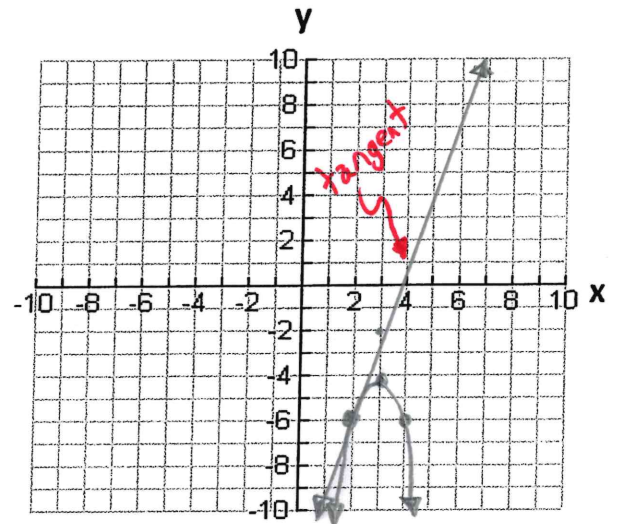
Sub ③ into ①

$$y = 4(2) - 14$$

$$y = -6$$

∴ The P.O.I.

is  $(2, -6)$



### Example 3

Determine the point(s) of intersection of the parabola  $y = x^2 + 4x + 5$  and the line  $y = x - 2$ .

①  $y = x^2 + 4x + 5$

②  $y = x - 2$

Sub ② into ①

$$x - 2 = x^2 + 4x + 5$$

$$0 = x^2 + 3x + 7$$

$$b^2 - 4ac$$

$$= (3)^2 - 4(1)(7)$$

$$= 9 - 28$$

$$= -19$$

Negative,  
No Sol'n

