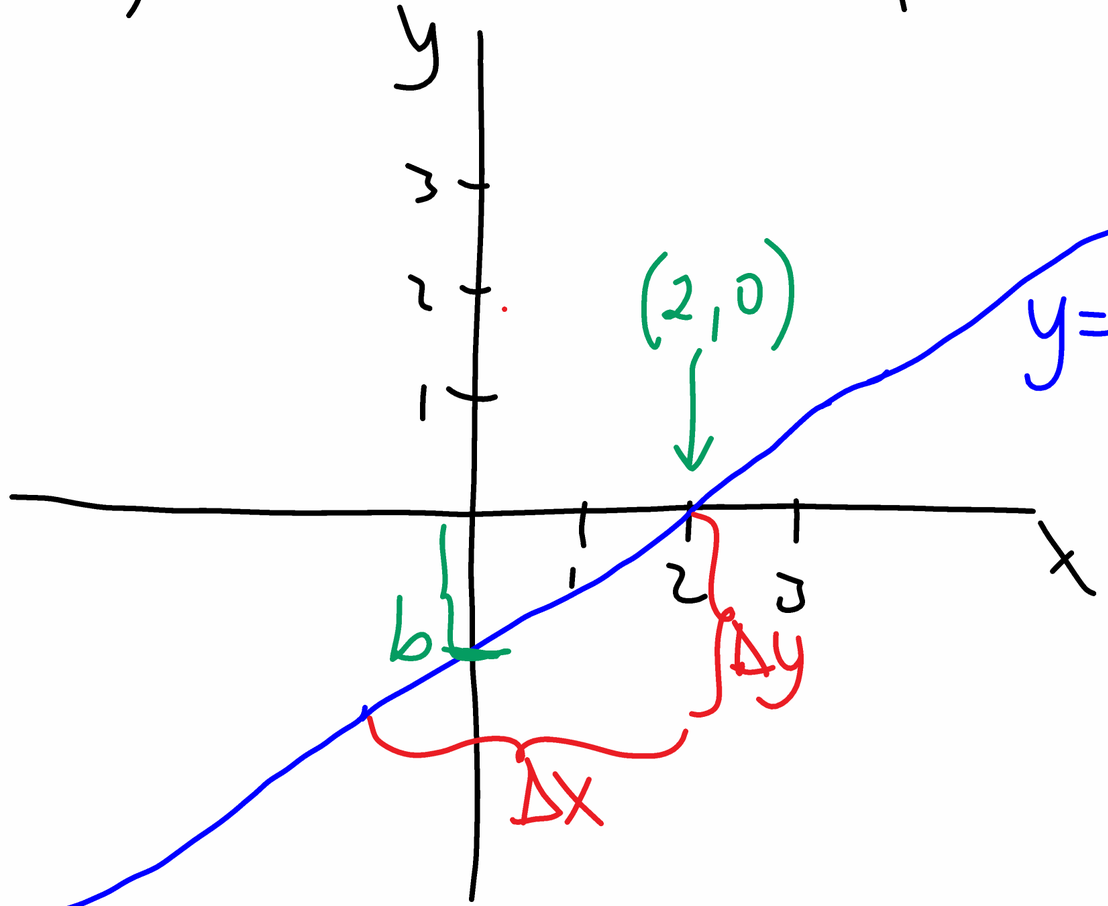
LINEAR-QUADRATIC EQUATIONS

FRI 29 MAR 2019

Reminder/Review: General formula of a (straigth) line

$$y = mx + b$$



$y = \frac{2}{3}x - \frac{4}{3}$

$m = \frac{\Delta y}{\Delta x}$ ≡ "slope"

≡ "rise over run"

$m = \frac{2}{3}$

$0 = \frac{2}{3} \cdot 2 + b \Rightarrow b = -\frac{4}{3}$

Difference between a quadratic func & a linear one?

Ans: Quadratics have a squared, e.g., x^2+7

Linear function do not, e.g., $3x-7$

LINEAR - QUADRATIC EQUATION

Do the following in Geogebra

1) Plot line $y = \frac{2}{3}x - \frac{4}{3}$

2) Plot the parabola $y = (x-1)^2 - 2$

3) Question: On how many points do both functions intersect? Ans: 2

4) Determine approximately, i.e., on the graph, those points

$P_1 \simeq (2.\overline{6}, 0.4)$ $P_2 \simeq (0.1, -1.2)$

QUESTION: How can we determine those 2 intersection points using only the formulae for both functions?

ANWSER: This is exactly today's lesson ☺

At any of the two points where both functions meet both x-values are the same & so do the y-values of each function.

In terms of formulas:

$$\left.\begin{array}{l} y=\frac{2}{3}x-\frac{4}{3} \\ y=(x-1)^2-2 \end{array}\right\} \Rightarrow \frac{2}{3}x-\frac{4}{3}=(x-1)^2-2$$

$$\frac{2}{3}x - \frac{4}{3} = (x-1)^2 - 2$$

We want to develop the right-hand-side in order to get a standard quadratic equation.

$$\frac{2}{3}x - \frac{4}{3} = x^2 - 2x + 1 - 2 = x^2 - 2x - 1$$

$$x^2 - 2x - 1 - \frac{2}{3}x + \frac{4}{3} = 0$$

$$x^2 - \frac{8}{3}x + \frac{1}{3} = 0$$

$$x = \frac{\frac{8}{3} \pm \sqrt{\left(\frac{8}{3}\right)^2 - 4 \cdot 1 \cdot \frac{1}{3}}}{2 \cdot 1} =$$

$$= \frac{\frac{8}{3} \pm \sqrt{\frac{64}{9} - \frac{4}{3}}}{2} = \frac{\frac{8}{3} \pm \sqrt{\frac{64}{9} - \frac{12}{9}}}{2} = \frac{\frac{8}{3} \pm \sqrt{52/9}}{2}$$

$$\simeq \frac{\frac{8}{3} \pm \frac{7.21}{3}}{2} = \frac{\frac{8 \pm 7.11}{3}}{2} = \frac{8 \pm 7.21}{6} \begin{cases} + \; 2.54 \\ - \; 0.13 \end{cases}$$

Hence, the first intersection point is

$$y = \frac{2}{3}x - \frac{4}{3}$$ & substitute $x = 2.54$

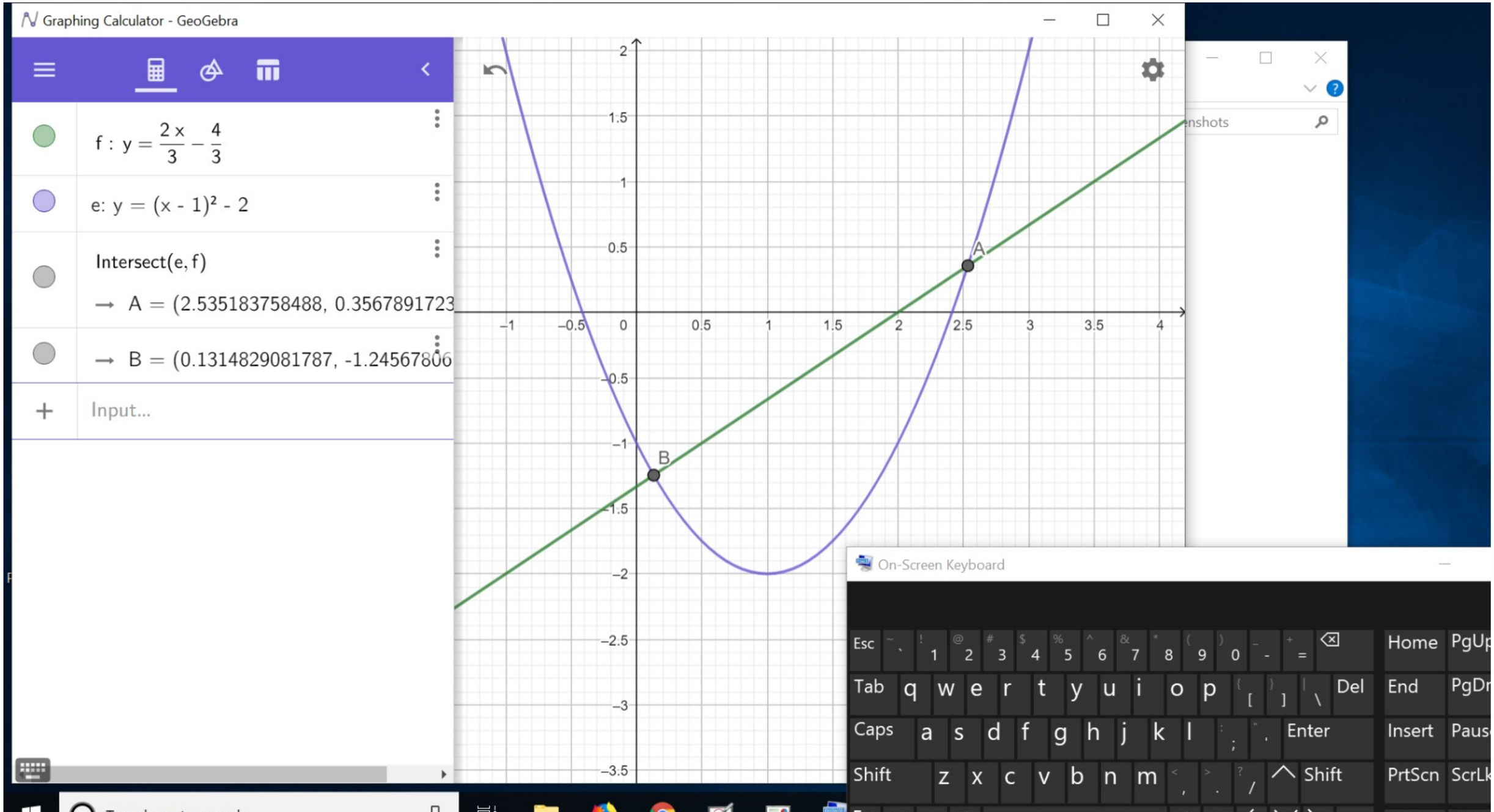
that gives $y = \frac{2}{3}(2.54) - \frac{4}{3} \simeq 0.36$

So the first point of intersection is $(2.54, 0.36)$

The second point is given by

$$y = \frac{2}{3}\cdot(0.13) - \frac{4}{3} \simeq -1.25$$

Hence, the other point is $(0.13, -1.25)$


Graphing Calculator - GeoGebra
f : y = 2x/3 − 4/3
e: y = (x - 1)² - 2
Intersect(e, f)
→ A = (2.535183758488, 0.3567891723
→ B = (0.1314829081787, -1.24567806
Input...
A
B
On-Screen Keyboard