

2. Fractions

e.g. write as a single fraction in its simplest form

$$\frac{\left(x - \frac{3}{x+2}\right)(x+2)}{\left(x - \frac{15+4x}{x+2}\right)(x+2)}$$

x by Len
 $\frac{(x+2)}{(x+2)}$

$$\frac{x(x+2) - 3}{x(x+2) - (15+4x)}$$

$$\frac{x^2 + 2x - 3}{x^2 + 2x - 15 - 4x}$$

$$= \frac{x^2 + 2x - 3}{x^2 - 2x - 15}$$

$$= \frac{(x+3)(x-1)}{(x-5)(x+3)}$$

$$= \frac{x-1}{x-5}$$

3. Surds

e.g. simplify

$$\left(\frac{2\sqrt{x}}{1+x}\right)\left(\frac{\sqrt{x} + \frac{1}{\sqrt{x}}}{1}\right)$$

where $x \in \mathbb{R}, x > 0$

BoWte
 single fraction

$$= \left(\frac{2\sqrt{x}}{1+x}\right)\left(\frac{\sqrt{x}\sqrt{x} + (1)(\frac{1}{\sqrt{x}})}{1(\sqrt{x})}\right)$$

$$= \left(\frac{2\sqrt{x}}{1+x}\right)\left(\frac{x+1}{\sqrt{x}}\right)$$

$$= 2$$

5. Linear equations

e.g. solve the simultaneous equations

$$4x + 5y = 22$$

$$2x + 3y = 12$$

(i) by algebra

(ii) by drawing a graph

6. Linear simultaneous equations

e.g. solve the simultaneous equations

$$3x + 2y - z = 5$$

$$4x + 5y + 2z = 11$$

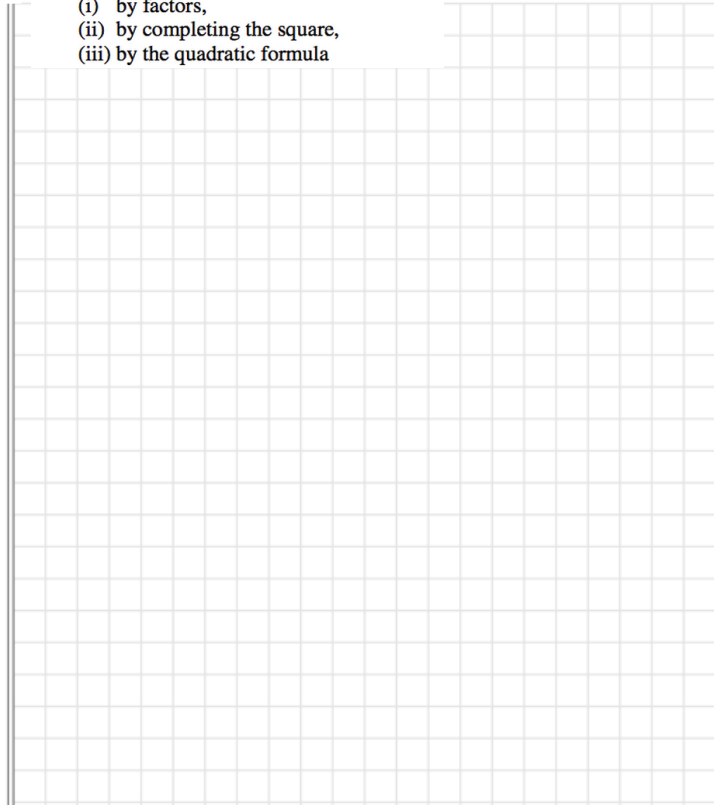
$$x - 3y + z = 8$$

7. Solving quadratic equations

e.g. solve the equation

$$2x^2 - 5x - 3 = 0$$

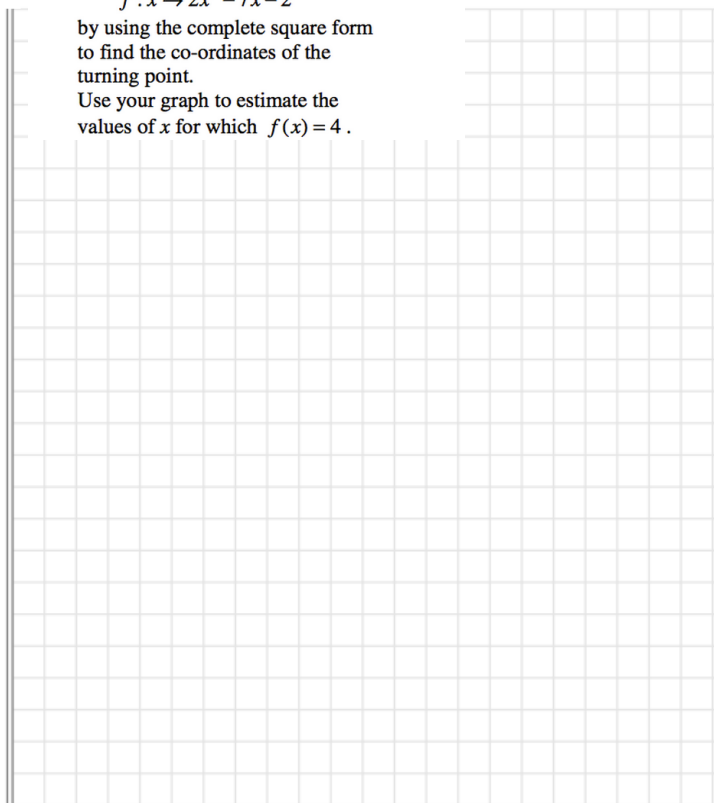
- (i) by factors,
- (ii) by completing the square,
- (iii) by the quadratic formula

**8. Quadratic graphs**

e.g. Construct a graph of the function

$$f : x \rightarrow 2x^2 - 7x - 2$$

by using the complete square form to find the co-ordinates of the turning point.

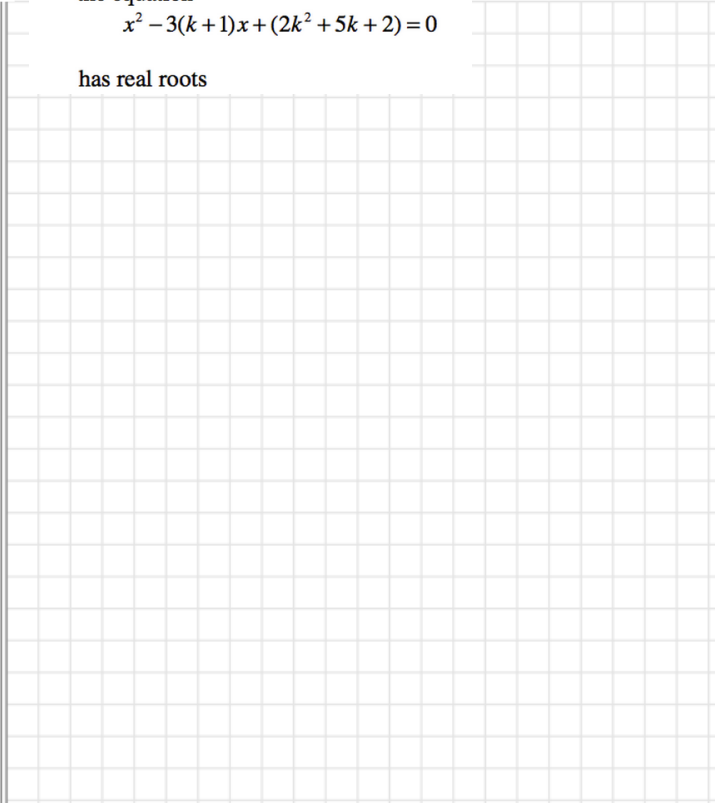
Use your graph to estimate the values of x for which $f(x) = 4$.

9. Nature of quadratic roots

e.g. show that for all values of $k \in \mathbb{R}$,
the equation

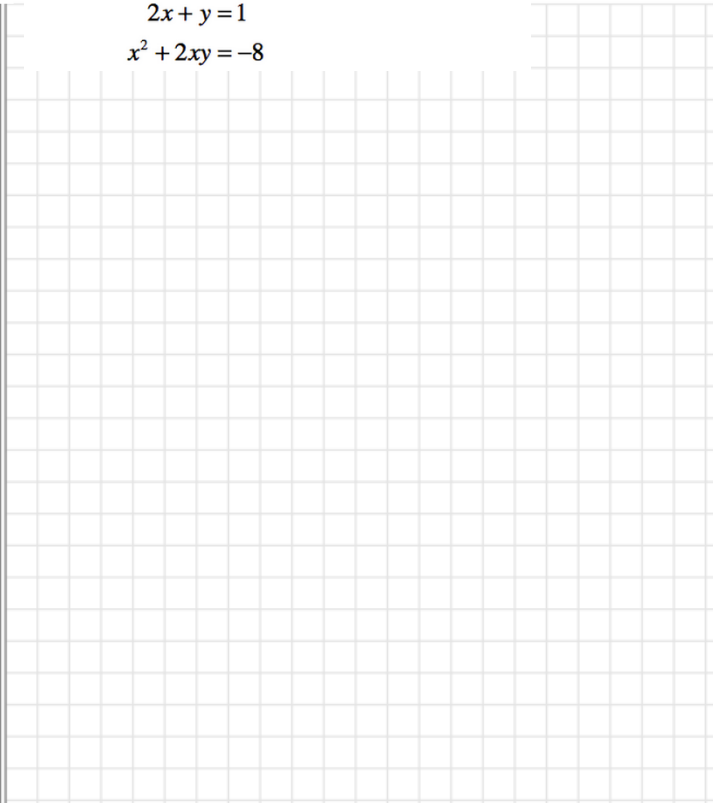
$$x^2 - 3(k+1)x + (2k^2 + 5k + 2) = 0$$

has real roots

**10. Linear, non-linear simultaneous equations**

e.g. solve the simultaneous equations

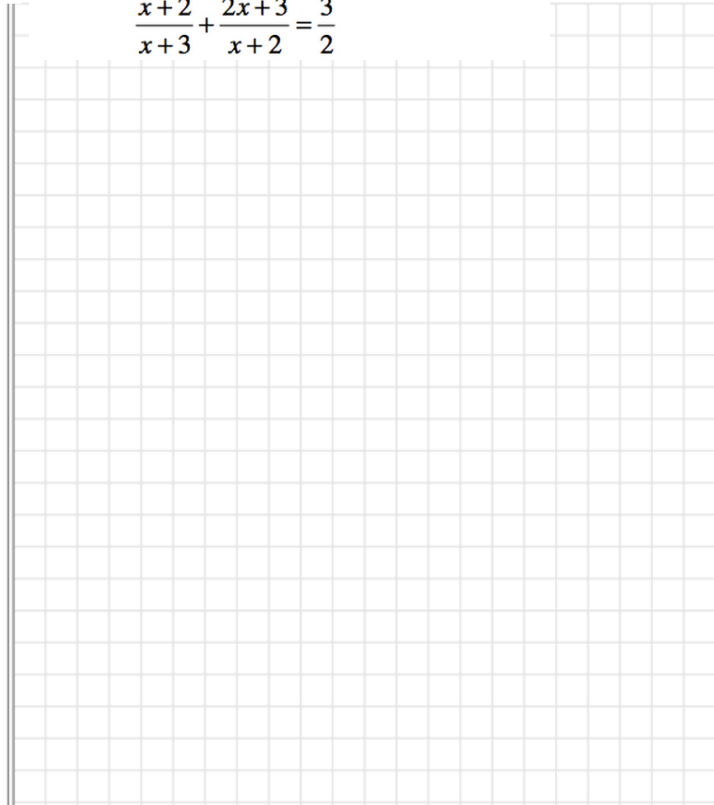
$$2x + y = 1$$

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


11. Rational equations

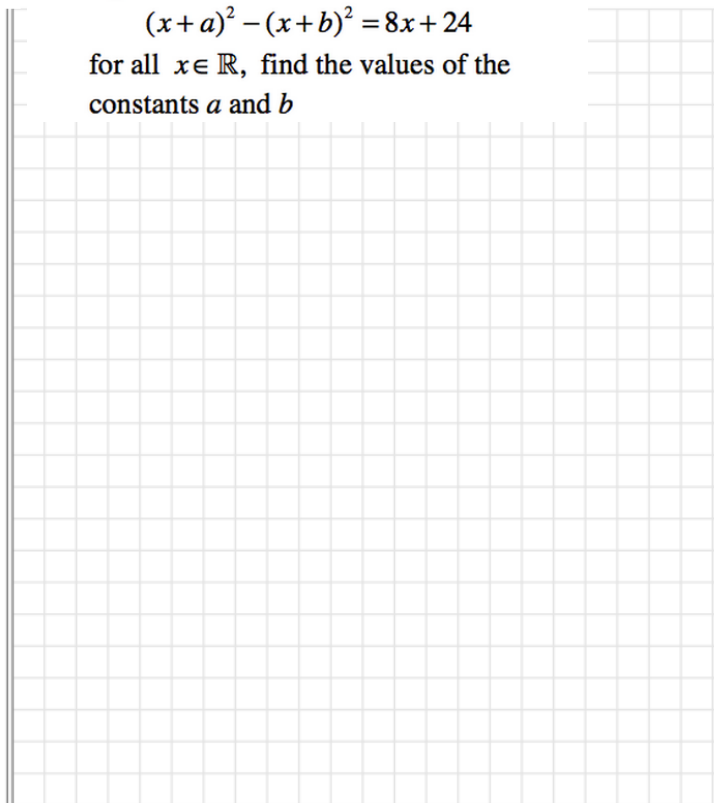
e.g. Solve the equation

$$\frac{x+2}{x+3} + \frac{2x+3}{x+2} = \frac{3}{2}$$

**13. Identities**

e.g. if

$$(x+a)^2 - (x+b)^2 = 8x+24$$

for all $x \in \mathbb{R}$, find the values of the constants a and b 

14. Use of the Factor Theorem to factorise cubics and solve cubic equations

e.g. if $x-1$ and $x-2$ are factors of

$$f : x \rightarrow ax^3 + bx^2 + x + 2,$$

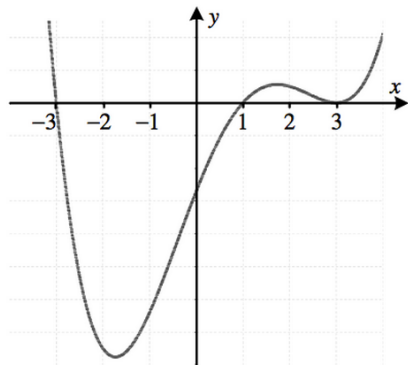
find the values of the constants a and b , and find the third solution of the equation $f(x) = 0$

15. Quadratic factor of a cubic

e.g. if $a \neq b$ and $x^2 + ax + b$ is a factor of $x^3 + bx^2 + ax + c$, show that

$$c = b(b+1)$$

- 16. Graphing polynomial curves**
 e.g. The graph of the polynomial
 $y = f(x)$
 of degree 4 is shown below.



- (i) Find an expression for the polynomial $f(x)$.
- (ii) If the curve contains the point $(0, -54)$, find the equation of the curve $y = f(x)$.

19. Rational inequalities

e.g. solve

$$\frac{x+3}{x-4} > -2, \quad x \in \mathbb{R}, x \neq 4$$

