15. $ax^2+bx+c=0$ by C.T.S.

$$\frac{\cancel{a}x^2}{\cancel{a}}+\frac{bx}{a}=-\frac{c}{a}$$

$$\left(\frac{1}{2}\text{ of }\frac{b}{a}\right)^2$$

$$x^2+\frac{b}{a}x=-\frac{c}{a}$$

$$\left(\frac{b}{2a}\right)^2$$

$$x^2+\frac{b}{a}x+\frac{b^2}{4a^2}=\frac{-c}{a}+\frac{b^2}{4a^2}$$

$$\left(x+\frac{b}{2a}\right)\left(x+\frac{b}{2a}\right)=\frac{-4ac}{4a^2}+\frac{b^2}{4a^2}$$

$$\cancel{\pm}\cancel{\sqrt{\left(x+\frac{b}{2a}\right)^{\cancel{2}}}}=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$$

$$x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-4ac}}{\sqrt{4a^2}}$$

$$x+\cancel{\frac{b}{2a}}-\cancel{\frac{b}{2a}}=\frac{\pm\sqrt{b^2-4ac}}{2a}-\frac{b}{2a}$$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

4.4 Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Warm-up: Find the roots of $3x^2 + 5x = 2$.

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(3)(-2)}}{2(3)}$$

$$= \frac{-5 \pm \sqrt{49}}{6}$$

$$= \frac{-5 \pm 7}{6}$$

$$= \frac{-5+7}{6} = \frac{1}{3}$$

$$= \frac{-5-7}{6} = -2$$

$b^2 - 4ac$ is called the DISCRIMINANT.

This value tells us the "nature of the roots."

① $b^2 - 4ac > 0$ 2 real (distinct) roots

$\rightarrow b^2 - 4ac = PS$ 2 rational (distinct) roots

② $b^2 - 4ac = 0$ 1 real (2 equal) roots

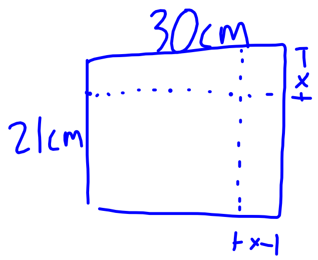
③ $b^2 - 4ac < 0$ 0 real roots (imaginary/complex)

Determine the nature of the roots. $(b^2 - 4ac)$

a) $x^2 - 5x + 4 = 0$ $(-5)^2 - 4(1)(4) = 9$ 2 real (2 rational)

b) $3x^2 + 4x + \frac{4}{3} = 0$ $(4)^2 - 4(3)(\frac{4}{3}) = 0$ 1 real

c) $2x^2 - 8x + 9 = 0$ $(-8)^2 - 4(2)(9) = -8$ 0 real pg. 252 Your Turn



Orig area = 630cm^2

New area = 252 cm^2

$$252 = (30-x)(21-x)$$
$$252 = 630 - 30x - 21x + x^2$$
$$0 = x^2 - 51x + 378$$

$(x-9)(x-42)$

$$x = \frac{+51 \pm \sqrt{(-51)^2 - 4(1)(378)}}{2(1)}$$

$$= \frac{51 \pm 33}{2} \rightarrow \cancel{42\text{cm}}$$
$$\rightarrow 9\text{cm}$$

Read Key Ideas pg. 253

pg. 254-257

#1,2 (discriminant)

#3-5 (quad. form)

#6,7,23 (choose your method)

#8-16 (modelling)

#17-20 (extend)

#21,22 (connect)