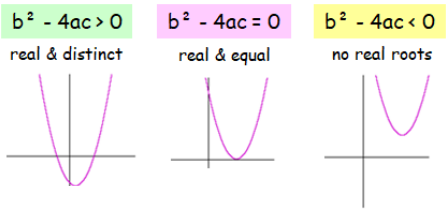

Outcome 1 – Solving for equal roots

Bronze examples

Examples... $\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

The roots of these quadratic equations are equal. What are the value(s) of k?

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

For equal roots $b^2 - 4ac = 0$

a = k, b = -8, c = 2

$64 - 4(2k) = 0$

$64 - 8k = 0$

$-8k = -64$

$k = \frac{-64}{-8} = 8$

$x^2 + kx + 4 = 0$

For equal roots $b^2 - 4ac = 0$

a = 1, b = k, c = 4

$k^2 - 4(4) = 0$

$k^2 - 16 = 0$

$(k + 4)(k - 4) = 0$

$k = -4, 4$

Bronze questions

The roots of these quadratic equations are equal. What are the value(s) of k?

1. $kx^2 + 4x + 5 = 0$
2. $kx^2 + x + 4 = 0$
3. $kx^2 - 2x + 4 = 0$
4. $kx^2 + 3x - 1 = 0$
5. $x^2 - kx + 9 = 0$
6. $x^2 + 2kx + 64 = 0$
7. $4x^2 + kx + 9 = 0$
8. $5x^2 - 2x + k = 0$
9. $10x^2 - 6x - k = 0$
10. $4x^2 + 2x - k = 0$

Outcome 2 – Solving for real or no real roots

Silver example

Examples... $\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

This quadratic equation has real roots. What are the range values of k?

$2x^2 - 3x + k = 0$

For real roots $b^2 - 4ac \geq 0$

a = 2, b = -3, c = k

$9 - 4(2k) \geq 0$

$9 - 8k \geq 0$

$-8 \geq -9$

$\div(-8)$ $\div(-8)$

$k \leq \frac{9}{8}$

If the letter you are trying to find is negative the inequalities sign must CHANGE DIRECTION.

Silver questions

The roots of these quadratic equations are real. What are the range of values of k?

1. $kx^2 + 6x - 7 = 0$
2. $x^2 - 2x - k = 0$
3. $3x^2 - 7x + k = 0$
4. $kx^2 + 9x + 3 = 0$

These quadratic equations have no real roots. What are the range of values of k?

5. $kx^2 - 4x - 2 = 0$
6. $10x^2 + 5x - k = 0$
7. $3x^2 + x + 2k = 0$
8. $kx^2 - 9x + 6 = 0$

Outcome 3 – Solving for equal, real or no real roots – hard algebra!

Gold example

Example... This quadratic equation has equal roots. What are the values of c?

$\frac{(x-5)^2}{x^2+5} = c$

Set = 0!

Write in the form $ax^2 + bx + c = 0$

$(x-5)^2 = cx^2 + 5c$

$x^2 - 10x + 25 = cx^2 + 5c$

$x^2 - 10x + 25 - cx^2 - 5c = 0$

$x^2 - cx^2 - 10x + 25 - 5c = 0$

$(1-c)x^2 - 10x + 25 - 5c = 0$

For equal roots... $b^2 - 4ac = 0$

a = 1 - c, b = -10, c = 25 - 5c

$100 - 4(1-c)(25-5c) = 0$

$100 - 4(25 - 30c + 5c^2) = 0$

$100 - 100 + 120c - 20c^2 = 0$

$120c - 20c^2 = 0$

$20c(c - 6) = 0$

$20c^2 - 120c = 0$

$c = 0, 6$

Gold questions

1. The equation $x^2 + kx + k - 5 = x - 4$ has equal roots. Find the values of k.
2. Given that $x^2 + 5p = -px + 24$ has no real roots, find the range of values for p.
3. Find the range of values of c such that the equation $x^2 + cx + 2c = 6x + 12$ has real roots.
4. This quadratic equation has equal roots. What are the values of m? $\frac{(x-2)^2}{x^2+2} = m$

Bronze Answers

1. $k = 4/5$
2. $k = 1/16$
3. $k = 1/4$
4. $k = -9/4$
5. $k = 6, -6$
6. $k = 8, -8$
7. $k = -12, 12$
8. $k = 1/5$
9. $k = -9/10$
10. $k = -1/4$

Silver Answers

1. $k \geq -9/7$
2. $k \geq -1$
3. $k \leq 49/12$
4. $k \leq 27/4$
5. $k < -2$
6. $k < -5/8$
7. $k > 1/24$
8. $k > 27/8$

Gold Answers

1. $k = 1, k = 5$
2. $8 < p < 12$
3. $c \leq 6, c \geq 14$
4. $m = 0, 3$