Outcome 1 – Determining the nature of the roots, solving for equal roots and solving for no real roots/real roots

Bronze examples

Examples...

Calculate the discriminant and determine the nature of the roots...

$2x^2 + 6x + 1 = 0$ $a = 2$, $b = 6$, $c = 1$

$36 - 4(2) = 28$

Since $b^2 - 4ac > 0$, roots are...

...real and distinct.

$x^2 - 8x + 16 = 0$ $a = 1$, $b = -8$, $c = 16$

$64 - 4(16) = 0$

Since $b^2 - 4ac = 0$, roots are...

...real and equal.

Silver examples

Examples...

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

$kx^2 - 8x + 2 = 0$ $a = k$, $b = -8$, $c = 2$

$64 - 4(2k) = 0$

$64 - 8k = 0$

$-8k = -64$

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

$x^2 + kx + 4 = 0$ $a = 1$, $b = k$, $c = 4$

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

$k^2 - 16 = 0$

$k^2 = 16$

$k = 4, -4$

Gold example

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

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

$3x^2 - 2x + k = 0$ $a = 3$, $b = -2$, $c = k$

$4 - 4(3k) \geq 0$

$4 - 12k \geq 0$

$-12k \geq -4$

$k \leq \frac{1}{3}$

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

Bronze Questions

Calculate the discriminant and determine the nature of the roots for the following quadratic equations...

1. $x^2 + 8x + 3 = 0$
2. $x^2 + 2x + 11 = 0$
3. $3x^2 + 7x + 8 = 0$
4. $9x^2 + 6x + 1 = 0$
5. $6x^2 - 9x + 2 = 0$
6. $x^2 + 10x + 25 = 0$
7. $2x^2 + 7x - 4 = 0$
8. $6x^2 - 9x + 5 = 0$
9. $8x^2 - 8x - 8 = 0$
10. $3x^2 + 4x - 2 = 0$

Silver Questions

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

1. $kx^2 + 4x + 2 = 0$
2. $kx^2 + x + 7 = 0$
3. $kx^2 - 6x + 1 = 0$
4. $kx^2 + 2x - 3 = 0$
5. $x^2 - kx + 4 = 0$
6. $x^2 + 2kx + 16 = 0$
7. $3x^2 + kx + 3 = 0$
8. $3x^2 - 4x + k = 0$
9. $9x^2 - 5x - k = 0$
10. $7x^2 + 2x - k = 0$

Gold Questions

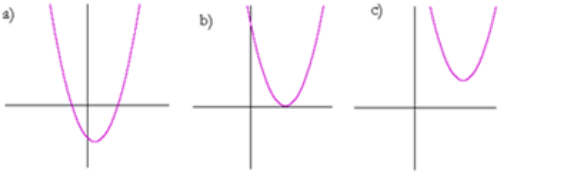
The roots of these quadratic equations are real. What are the range of values of k?

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

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

5. $kx^2 - 12x - 5 = 0$
6. $25x^2 + 10x - k = 0$
7. $4x^2 + x + k = 0$
8. $kx^2 - 6x + 4 = 0$

$b^2 - 4ac > 0$	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$
real & distinct	real & equal	no real roots



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Bronze Answers

1. 52, real & distinct
2. -40, no real roots
3. -47, no real roots
4. 0, real & equal
5. 33, real & distinct
6. 0, real & equal
7. 81, real & distinct
8. -39, no real roots
9. 320, real & distinct
10. 40, real & distinct

Silver Answers

1. $k = 2$
2. $k = 1/28$
3. $k = 9$
4. $k = -1/3$
5. $k = 10, -10$
6. $k = 4, -4$
7. $k = 6, -6$
8. $k = 4/3$
9. $k = -25/36$
10. $k = -1/7$

Gold Answers

1. $k \geq -25/12$
2. $k \geq -9/4$
3. $k \leq 49/8$
4. $k \leq 4$
5. $k < -36/5$
6. $k < -1$
7. $k > 1/16$
8. $k > 9/4$

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