I. Model Problems.
II. Practice
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Web Resources

How To Solve Quadratic Equations: www.mathwarehouse.com/quadratic/solve-quadratic-equation.php

Discriminant: www.mathwarehouse.com/quadratic/discriminant-in-quadratic-equation.php

Using the Discriminant

The discriminant of a quadratic equation $ax^2 + bx + c = 0$, is $b^2 - 4ac$. The discriminant is found inside the square root of the quadratic formula. The discriminant tells us the number and nature of the roots of the quadratic.

If the discriminant is:	Number and Nature	number of x-intercepts of the graph of the related function
Positive	two real roots	2 x-intercepts
Zero	one real root (a double root)	1 x-intercept
Negative	two imaginary roots/ no real roots	0 x-intercepts

In the following examples you will use the discriminant to determine the number and nature of the roots. Find the number of x-intercepts of the parent graph.

Example 1: **Find the discriminant to determine the number and nature of the roots of the equation $3x^2 - 2x + 5 = -12$**

Rewrite the problem.
$$3x^2 - 2x + 5 = -12$$

Write in standard form.
$$\begin{array}{r} +12 \quad +12 \\ \hline 3x^2 - 2x + 5 \qquad = 0 \end{array}$$

Identify *a, b,* and *c*.
$$a = 3, b = -2, c = 5$$

Substitute into discriminant.
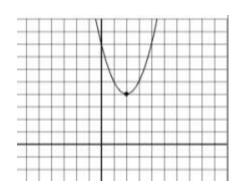$$b^2 - 4ac$$
$$(3)^2 - 4(-2)(5)$$
$$9 + 40$$
$$49$$

The discriminant is positive therefore the equation has two real solutions. There are 2 x-intercepts.
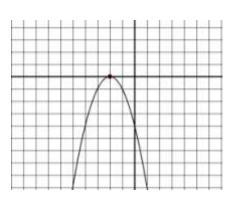
II. Practice using the discriminant.

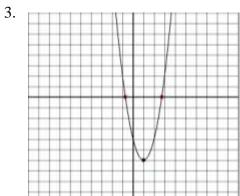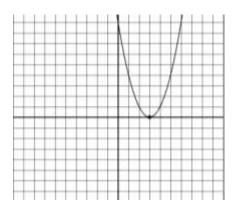**Given the graph below determine a) the sign of the discriminant b) the number and nature of the roots.**
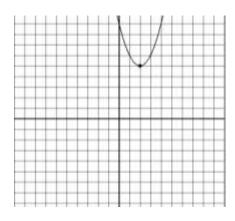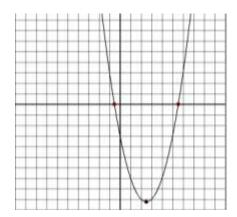
1.

2.

3.

4.

5.

6.

Find the discriminant to determine the number and nature of the roots of the equation.

7. $x^2 + 6x + 4 = 0$ 8. $x^2 - 5x - 34 = 0$

9. $2x^2 - 3x + 2 = 0$ 10. $3x^2 - 6x + 2 = 0$

11. $3x + 7 = -5x^2 - 4$ 12. $-3x^2 + 17x - 2 = 3$

13. $25x^2 - 15x - 64 = 5x - 10$

Find the discriminant to determine the number of x-intercepts of the function.

14. $f(x) = 3x^2 - 4x + 2$ 15. $f(x) = -2x^2 + 6x - 8$

16. $f(x) = x^2 - 7x + 6$ 17. $f(x) = 9x^2 + 24x + 16$

18. $f(x) = x^2 - 3x + 4$ 19. $f(x) = -x^2 - 4$

20. $f(x) = 4x^2 - 28x + 49$

III. Challenge Problems

21. Find all the values of a such that $ax^2 + 3x + 5 = 0$ has two real roots.

22. Find all the values of a such that $ax^2 + 48x + 64 = 0$ has one real root (a double root).

23. Find all the values of a such that $ax^2 + 3x - 6 = 0$ has two imaginary roots.

24. Find all the values of c such that $2x^2 - 6x + c = 0$ has two imaginary roots.

25. Find all the values of c such that $-4x^2 + 8x + c = 0$ has two real roots.

26. Assuming $b \neq 0$, does the sign of b affect the value of the discriminant?

IV. Answer Key

1. a) negative b) two imaginary roots/ no real roots
2. a) zero b) one real solution/double root
3. a) positive b) two real roots
4. a) zero b) one real solution/double root
5. a) negative b) two imaginary roots/ no real roots
6. a) positive b) two real roots
7. two real roots
8. two real roots
9. two imaginary roots/ no real roots
10. two real roots
11. two imaginary roots/ no real roots
12. two real roots
13. one real solution/double root
14. 0
15. 2
16. 2
17. 1
18. 0
19. 0
20. 1
21. $a < \frac{9}{20}$
22. $a = 9$
23. $a < \frac{3}{8}$
24. $c > \frac{9}{2}$
25. $c > -4$
26. no, b is squared resulting in a positive number