Find the discriminant to determine the number of real roots of the equation.

a. $3x^2 + 3x - 6 = 0$

b. $w^2 + w - 6 = 0$

c. $x^2 + 8x + 16 = 0$

d. $m^2 + m + 1 = 0$

e. $3k^2 + 6k - 24 = 0$

f. $2e^2 + 3e + 2 = 0$

g. $2d^2 - 12d + 18 = 0$

h. $2u^2 + 4u - 16 = 0$

i. $3s^2 + 12s + 12 = 0$

j. $q^2 + 4q - 5 = 0$

KEYS

Consider the general quadratic equation $ax^2 + bx + c = 0$. The quantity $b^2 - 4ac$ is called the discriminant of the quadratic equation and determine the type and number of roots which arises from a quadratic equation. When

- $b^2 - 4ac > 0$, the equation has two real roots.
- $b^2 - 4ac < 0$, the equation has no real roots.
- $b^2 - 4ac = 0$, the equation has one real root (double root).

a. $3x^2 + 3x - 6 = 0$

	$b^2 - 4ac$	
=	$3^2 - 4(3)(-6)$	Plug in a=3, b=3, and c=–6
=	$9 + 64$	Multiply
=	72	Add

$b^2 - 4ac > 0 \Rightarrow$ The equation has two real roots.

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b. $w^2 + w - 6 = 0$

	$b^2 - 4ac$	
=	$1^2 - 4(1)(-6)$	Plug in a=1, b=1, and c=–6
=	$1 + 24$	Multiply
=	25	Add

$b^2 - 4ac > 0 \Rightarrow$ The equation has two real roots.

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c. $x^2 + 8x + 16 = 0$

	$b^2 - 4ac$	
=	$8^2 - 4(1)(16)$	Plug in a=1, b=8, and c=16
=	$64 - 64$	Multiply
=	0	Subtract

$b^2 - 4ac = 0 \Rightarrow$ The equation has one real root (double root).

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d. $m^2 + m + 1 = 0$

	$b^2 - 4ac$	
=	$1^2 - 4(1)(1)$	Plug in a=1, b=1, and c=1

=	$1 - 4$	Multiply
=	-3	Subtract

$b^2 - 4ac < 0 \Rightarrow$ The equation has no real roots.

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e. $3k^2 + 6k - 24 = 0$

	$b^2 - 4ac$	
=	$6^2 - 4(3)(-24)$	Plug in a=3, b=6, and c=–24
=	$36 + 288$	Multiply
=	324	Add

$b^2 - 4ac > 0 \Rightarrow$ The equation has two real roots.

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f. $2e^2 + 3e + 2 = 0$

	$b^2 - 4ac$	
=	$3^2 - 4(2)(2)$	Plug in a=2, b=3, and c=2
=	$9 - 16$	Multiply
=	-7	Subtract

$b^2 - 4ac < 0 \Rightarrow$ The equation has no real roots.

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g. $2d^2 - 12d + 18 = 0$

	$b^2 - 4ac$	
=	$(-12)^2 - 4(2)(18)$	Plug in a=2, b=–12, and c=18
=	$144 - 144$	Multiply
=	0	Subtract

$b^2 - 4ac = 0 \Rightarrow$ The equation has one real root (double root).

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h. $2u^2 + 4u - 16 = 0$

	$b^2 - 4ac$	
=	$4^2 - 4(2)(-16)$	Plug in a=2, b=4, and c=–16
=	$16 + 128$	Multiply
=	144	Add

$b^2 - 4ac > 0 \Rightarrow$ The equation has two real roots.

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i. $3s^2 + 12s + 12 = 0$

	$b^2 - 4ac$	
=	$(12)^2 - 4(3)(12)$	Plug in a=3, b=12, and c=12
=	$144 - 144$	Multiply
=	0	Subtract

$b^2 - 4ac = 0 \Rightarrow$ The equation has one real root (double root).

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j. $q^2 + 4q - 5 = 0$

	$b^2 - 4ac$	
=	$4^2 - 4(1)(-5)$	Plug in a=1, b=4, and c=–5
=	$16 + 20$	Multiply
=	36	Add

$b^2 - 4ac > 0 \Rightarrow$ The equation has two real roots.
