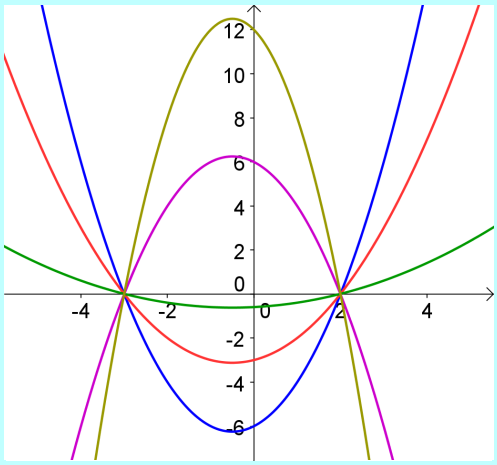
Families of Quadratic Relations

Do the zeroes of a quadratic relation provide sufficient information to determine its equation?



No. All of the graphs shown have the same zeroes at 2 and -3.

They are part of the same family of quadratic relations.

To determine the equation of a particular quadratic, another point is needed.

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Families of Quadratic Relations

Feb 20/2019

A group of quadratic relations which all share a common characteristic is called a family of quadratics.

The most common characteristics of interest are:

1. Zeroes
2. Vertex
3. y-intercept

same zeroes

$y = 3(x-2)(x+5)$

$y = -(x+5)(x-2)$

$y = x^2 + 3x - 10$

same y-intercepts

$y = x^2 + 3x - 10$

$y = -5x^2 - x - 10$

$y = 2(x+3)^2 - 28$

Note: The equations may not be in the same form.

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Ex. Determine the family of quadratics common to:

$y = -(x-6)(x+2)$

$y = 3(x-2)^2 + 16$

$y = -2x^2 + 8x + 8$

How can we test for the same vertex, zeroes, y-int?

What is the easiest place to start?

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Ex. Determine the family of quadratics common to:

$y = -(x-6)(x+2)$

$y = 3(x-2)^2 + 16$

$y = -2x^2 + 8x + 8$

<u>y-intercepts:</u>
- set x=0
- compare y-int

<u>zeroes:</u>
- find zeroes for one relation
- set x=s and x=t to test other relations
- in all tests, should get y=0

<u>vertex:</u>
- find vertex, V(h,k), for one relation
- set x=h in other relations
- in all tests, should get y=k

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Ex. Determine the family of quadratics common to:

$y = -(x-6)(x+2)$ ①

$y = 3(x-2)^2 + 16$ ②

$y = -2x^2 + 8x + 8$ ③

for y-int, set $x = 0$

$y_1 = -(-6)(2)$ $y_2 = 3(-2)^2 + 16$ $y_3 = 8$

$= 12$ $= 28$

for factors?

① put all in factored form

② set $y = 0$, solve

$0 = 3(x-2)^2 + 16$

$\frac{-16}{3} = (x-2)^2$

$\pm\sqrt{\frac{-16}{3}} = x-2 \Rightarrow$ no real solutions

③ sub zeroes from eq ① into eq ② or ③

$\Rightarrow y = 0$?

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same vertex ?

① CTS or ② symmetry

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Ex. Determine the equation of the quadratic relation, in standard form, that has roots of $1+\sqrt{5}$ and $1-\sqrt{5}$ and passes through:

(a) (2, 5)

(b) (2, 10)

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Assigned Work:

worksheet (full)

1, 2, 10, 12

$\frac{1}{2}$ pg
1

full
1, 10, 12

F.1 $y_1 = (x-5)(x+1)$
$y_2 = 2(x+2)^2 - 9$
$y_3 = -x^2 + 4x - 13$

① y-int, set $x = 0$
$y_3 = -13$ $y_1 = -5$ ✗

② zeroes, $x = 5$, $x = -1$
Sub $x = 5$:
$y_2 = 2(5+2)^2 - 9$
$= 89$
$\neq 0$ ✗

③ vertex, $V(-2, 9)$
Sub $x = -2$
$y_1 = (-2-5)(-2+1)$
$= (-7)(-1)$
$= 7$ ✗

∴ no families

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F.2 $y_1 = -2(x-9)(x-7)$
$y_2 = 3(x+8)^2 + 2$
$y_3 = 4x^2 - 64x + 258$

① y-int, set $x = 0$
$y_3 = 258$
$y_2 = 3(8)^2 + 2$ ✗
$= 194$

② vertex, $(-8, 2)$
$y_1 = -2(-8-9)(-8-7)$ ✗
$\neq 2$

③ zeroes, $x = 9$, $x = 7$
$y_2 = 3(9+8)^2 + 2$ ✗
$\neq 0$

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F.10 Zeroes: $2 \pm 2\sqrt{5}$

$P(8, 32)$

$y = a(x-s)(x-t)$

$s = 2+2\sqrt{5} \quad t = 2-2\sqrt{5}$

$y = a(x-(2+2\sqrt{5}))(x-(2-2\sqrt{5}))$

$y = a(x-2-2\sqrt{5})(x-2+2\sqrt{5})$

OR

$y = a((x-2)-(2\sqrt{5}))((x-2)+(2\sqrt{5}))$

$(p-q)(p+q)$

p^2-q^2

$y = a((x-2)^2-(2\sqrt{5})^2)$

$y = a(x^2-4x+4-20)$

$y = a(x^2-4x-16)$

to find a, sub $P(8, 32)$

$32 = a(8^2-4(8)-16)$

$32 = a(64-32-16)$

$32 = 16a$

$a = 2$

$y = 2(x^2-4x-16)$

$y = 2x^2-8x-32$

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12. $y_1 = 3x^2+18x-33$

$y_2 = a(x-s)(x-t)$

$P(-6, -44)$

$y_1 = 3(x^2+6x-11)$

$x = \frac{-6 \pm \sqrt{36-4(1)(-11)}}{2}$

$x = \frac{-6 \pm \sqrt{80}}{2}$ $\quad 80 = 4 \times 20$

$x = \frac{-6 \pm \sqrt{16}\sqrt{5}}{2}$ $\quad = 4 \times 4 \times 5$

$x = \frac{-6 \pm 4\sqrt{5}}{2}$ $\quad = 16 \times 5$

$x = -3 \pm 2\sqrt{5}$ zeroes

now similar to #10

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H.1 (a) zeroes, -4 and 3 P(2,7)

$y = a(x-s)(x-t)$

$y = a(x+4)(x-3)$

sub P(2,7)

$7 = a(6)(-1)$

$a = \frac{-7}{6}$

AofS: $x = \frac{-4+3}{2}$

$= \frac{-1}{2}$

sub $x = \frac{-1}{2}$

$y_v = \frac{-7}{6}(x+4)(x-3)$

$= \frac{-7}{6}(\frac{-1}{2}+4)(\frac{-1}{2}-3)$

$= \frac{-7}{6}(\frac{7}{2})(\frac{-7}{2})$

$= \frac{343}{24}$

$V(\frac{-1}{2}, \frac{343}{24})$

$4 = \frac{8}{2}$

$-3 = \frac{-6}{2}$

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