Families of Quadratic Relations

Feb 15/2011

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.

In this example, we were actually solving for the intersection between the parabola and the horizontal straight line.

Solutions: (-4, -8) and (-2, -8)

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Ex.1 Find the equation of a parabola with roots of -4 and 18 and an optimum value of 100.

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

$y = a(x+4)(x-18)$

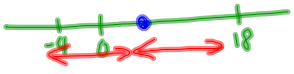
optimum value is the y_{vertex}

x_{vertex} is MP of zeroes

$x_v = \frac{-4+18}{2}$

$= \frac{14}{2}$

$= 7$



Vertex is $(7, 100)$, Sub point

$100 = a(7+4)(7-18)$

$100 = a(11)(-11)$

numbers same but opposite sign b/c MP is same distance from each zero

$100 = -121a$

$a = -\frac{100}{121}$

$y = -\frac{100}{121}(x+4)(x-18)$

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Ex.2 Determine the equation, in factored form, of the parabola that goes through the point (-5, 10) with zeroes at -8 and 5.

not vertex

don't expect symmetry

$y = a(x+8)(x-5)$

sub $(-5, 10)$

$10 = a(-5+8)(-5-5)$

$10 = a(3)(-10)$

$10 = -30a$

$a = -\frac{1}{3}$

$y = -\frac{1}{3}(x+8)(x-5)$

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Ex.3 Determine the equation (in factored form) of a quadratic which has x-intercepts -2 and 4 and a y-intercept of -5.

"zero, root"

$y = a(x+2)(x-4)$ → $(0, -5)$

sub $(0, -5)$

$-5 = a(2)(-4)$

$-5 = -8a$

$a = \frac{5}{8}$

$y = \frac{5}{8}(x+2)(x-4)$

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Ex.4 Determine the equation of the quadratic relation, in standard form, that passes through (2, 5) and has roots of $1+\sqrt{5}$ and $1-\sqrt{5}$.

$y = a(x-s)(x-t)$ $\quad s = 1+\sqrt{5}$, $t = 1-\sqrt{5}$

$y = a(x-(1+\sqrt{5}))(x-(1-\sqrt{5}))$

$y = a(x-1-\sqrt{5})(x-1+\sqrt{5})$

Sub $(2,5)$

$5 = a(2-1-\sqrt{5})(2-1+\sqrt{5})$

$5 = a(1-\sqrt{5})(1+\sqrt{5})$

$5 = a(1+\sqrt{5}-\sqrt{5}-\sqrt{25})$

$5 = a(1-5)$

$5 = -4a$

$a = -\frac{5}{4}$

$y = -\frac{5}{4}(x-1-\sqrt{5})(x-1+\sqrt{5})$

$y = -\frac{5}{4}(x^2-x+\cancel{x\sqrt{5}}\cancel{-x}+1\cancel{-\sqrt{5}}\cancel{-x\sqrt{5}}+\cancel{\sqrt{5}}-\sqrt{25})$

$y = -\frac{5}{4}(x^2-2x-4)$

$y = -\frac{5}{4}x^2+\frac{5}{2}(2x)+\frac{5}{1}(4)$

$y = -\frac{5}{4}x^2+\frac{5}{2}x+5$

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Assigned Work:

worksheet
photocopies from Nelson text (p.326 # 6, 18)

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