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Activity: Real World Systems Applications

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1. A rocket is launched from the ground and follows a parabolic path represented by the equation $y = -x^2 + 10x$. At the same time, a flare is launched from a height of 10 feet and follows a straight path represented by the equation $y + x = 10$. Using the accompanying set of axes, graph the equations that represent the paths of the rocket and the flare, and find the coordinates of the point or points where the paths intersect.

$y = -x^2 + 10x$

$y + x = 10$

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

$-x^2 + 11x = 10$

$+x^2 - 11x \quad -11x + x^2$

$0 = x^2 - 11x + 10$

$0 = (x - 10)(x - 1)$

$x = 10 \mid x = 1$

$y = 0 \mid y = 9$

$y + x = 10$

$y + 10 = 10$

$-10 \quad -10$

$y = 0$

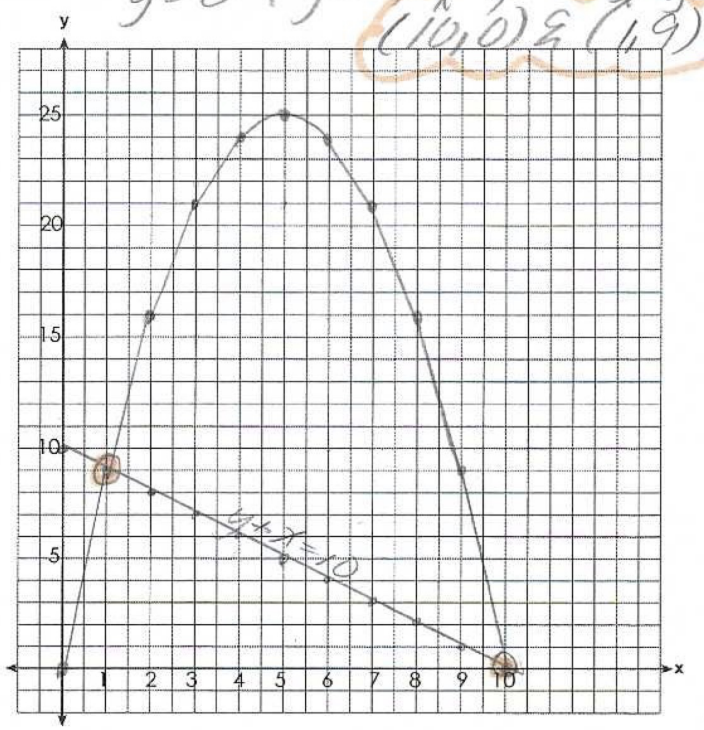
$y + x = 10$

$y + 1 = 10$

$-1 \quad -1$

$y = 9$

$(10, 0)$ & $(1, 9)$ quadratic



x	y
2	16
3	21
4	24
5	25
6	24
7	21
8	16
9	9
10	0

linear

$y = -x + 10$

$m = -1, \ b = 10$

Name: _____

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Glue on page 34

2. The price of a stock, A(x), over a 12-month period decreased and then increased according to the equation $A(x) = 0.75x^2 - 6x + 20$, where x equals the number of months. The price of another stock, B(x), increased according to the equation $B(x) = 2.75x + 1.50$ over the same 12-month period. Graph and label both equations on the accompanying grid. State all prices, to the *nearest dollar*, when both stock values were the same. Show algebraically.

$A(x) = B(x)$

$100[0.75x^2 - 6x + 20 = 2.75x + 1.50]$

$75x^2 - 600x + 2000 = 275x + 150$

$-275x - 150 \quad -275x - 150$

$75x - 875x + 1850 = 0$ use quadratic formula

$a = 75,\ b = -875,\ c = 1850$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-875) \pm \sqrt{(-875)^2 - 4(75)(1850)}}{2(75)}$$

$$x = \frac{875 \pm \sqrt{210625}}{150} = \begin{cases} 8.8929\ldots \text{ months} \\ 2.7737\ldots \text{ months} \end{cases}$$

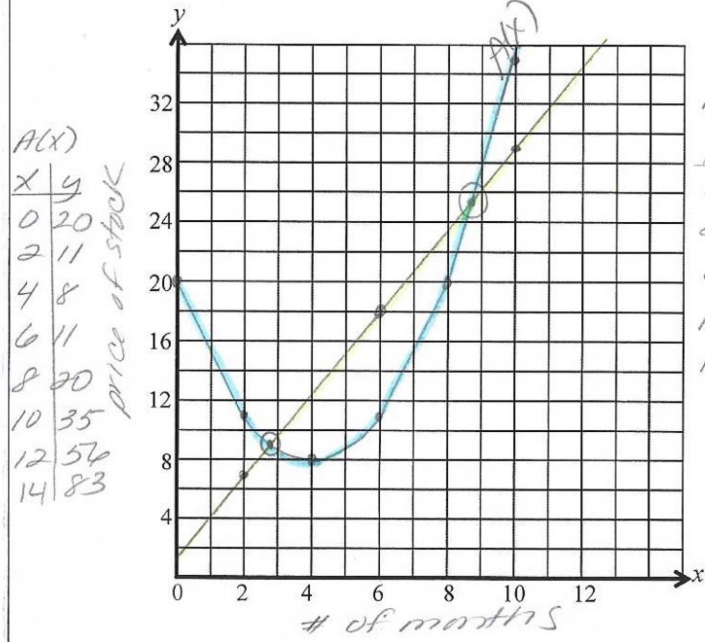
$B(8.89)$
$B(x) = 2.75(8.89) + 1.50$
$\approx \$25.95$
$= \$26$

$B(2.77)$
$B(x) = 2.75(2.77) + 1.50$
$\approx \$9.12$
$= \$9$

Solution $9 & $26

Graph for #2. Be sure to label.

$A(x) = 0.75x^2 - 6x + 20$ use calc.
$B(x) = 2.75x + 1.50$



A(x)

x	y
0	20
2	11
4	8
6	11
8	20
10	35
12	56
14	83

B(x)

x	y
0	1.5
2	7
6	18
10	29
14	40

3. A flare is launched from a boat. The height, h, in meters, of the flare above the water is approximately modeled by the function $h(t) = -15t^2 + 150t$, where t is the number of seconds after the flare is launched. How many seconds will it take for the flare to return to the water?

$0 = -15t^2 + 150t$ factor out gcf

$0 = -15t(t - 10)$

$\frac{0}{-15} = \frac{-15t}{-15}$ | $t - 10 = 0$ $+10 \quad +10$

$0 = t$ | $t = 10$ sec