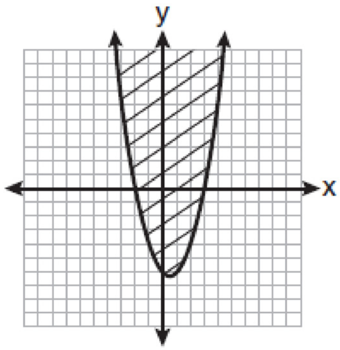
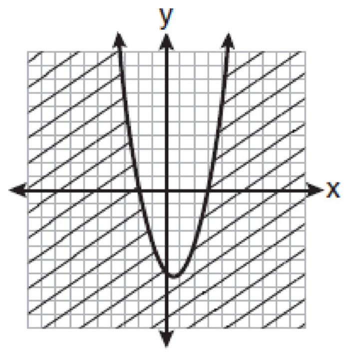
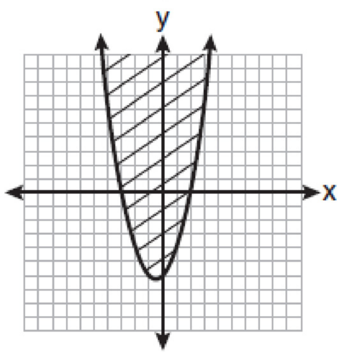
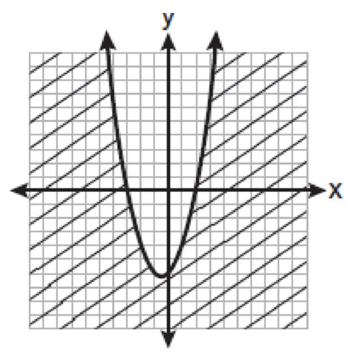
A2.A.4: Quadratic Inequalities 4: Solve quadratic inequalities in one and two variables, algebraically and graphically

1 Which graph best represents the inequality $y + 6 \geq x^2 - x$?

1) 

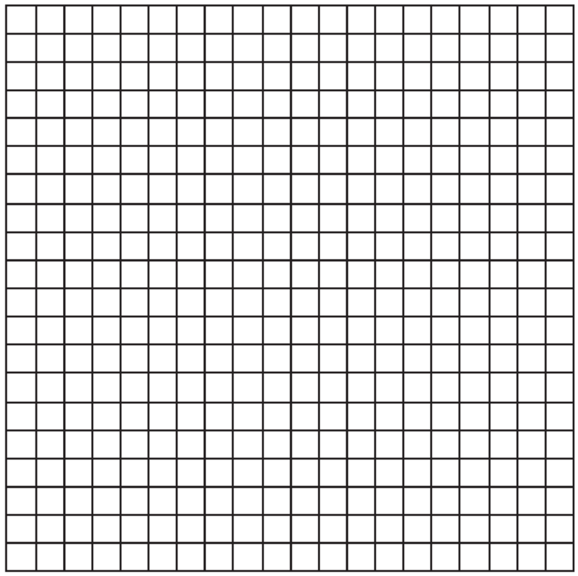
3) 

2) 

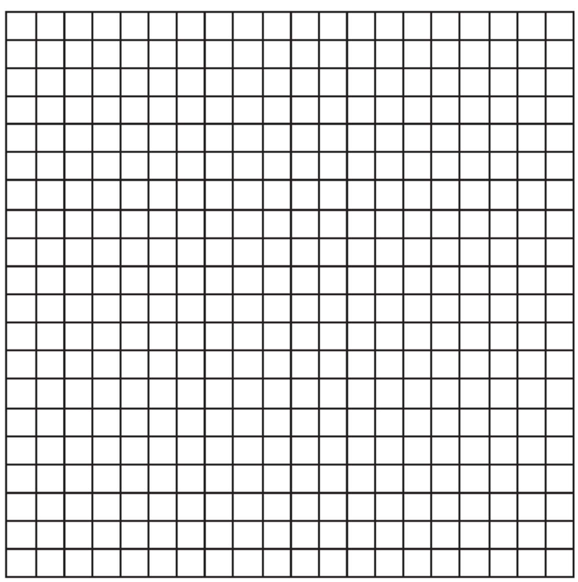
4) 

2 When a baseball is hit by a batter, the height of the ball, $h(t)$, at time t, $t \geq 0$, is determined by the equation $h(t) = -16t^2 + 64t + 4$. For which interval of time is the height of the ball greater than or equal to 52 feet?

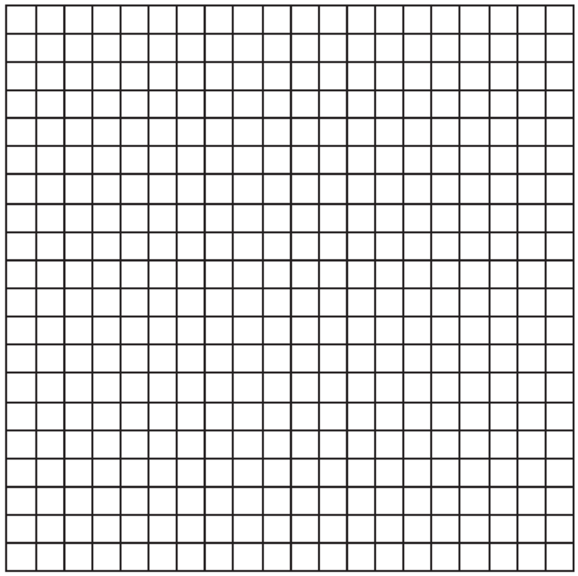
3 The profit a coat manufacturer makes each day is modeled by the equation $P(x) = -x^2 + 120x - 2000$, where P is the profit and x is the price for each coat sold. For what values of x does the company make a profit? [The use of the grid is optional.]



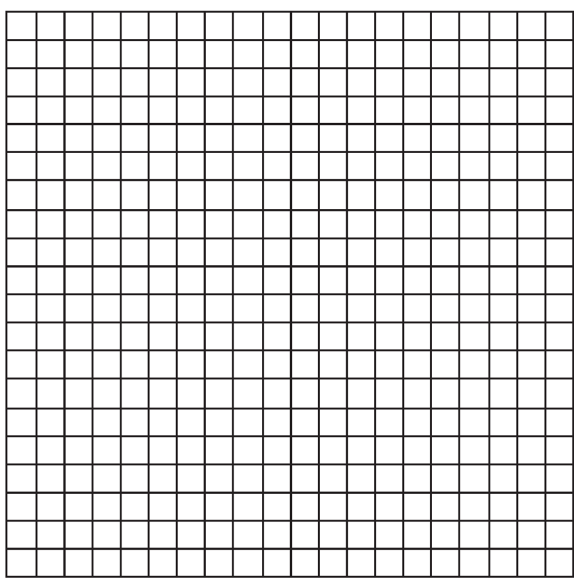
4 The profit, P, for manufacturing a wireless device is given by the equation $P = -10x^2 + 750x - 9{,}000$, where x is the selling price, in dollars, for each wireless device. What range of selling prices allows the manufacturer to make a profit on this wireless device? [The use of the grid is optional.]



5 The height of a projectile is modeled by the equation $y = -2x^2 + 38x + 10$, where x is time, in seconds, and y is height, in feet. During what interval of time, to the *nearest tenth of a second*, is the projectile *at least* 125 feet above ground? [The use of the accompanying grid is optional.]



6 A small rocket is launched from a height of 72 feet. The height of the rocket in feet, h, is represented by the equation $\mathrm{h}(t) = -16t^2 + 64t + 72$, where t = time, in seconds. Graph this equation on the accompanying grid. Use your graph to determine the number of seconds that the rocket will remain at or above 100 feet from the ground. [Only a graphic solution can receive full credit.]



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Answer Section

1 ANS: 1

$y \geq x^2 - x - 6$

$y \geq (x-3)(x+2)$

REF: 061017a2

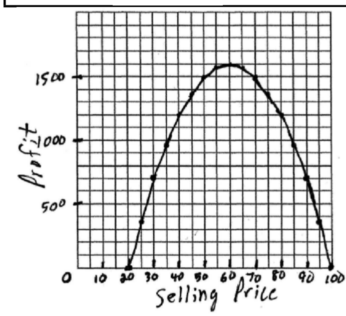
2 ANS:

$-16t^2 + 64t + 4 \geq 52$ $-16t^2 + 64t - 48 \geq 0$ $t^2 - 4t + 3 \leq 0$ $(t-3)(t-1) \leq 0$ For the product of these binomials to be negative, either: 1) $(t-3)$ must be negative AND $(t-1)$ must be positive; or 2) $(t-3)$ must be positive AND $(t-1)$ must be negative	CASE 1 $t-3<0$ AND $t-1>0$ $t<3$ $\quad$ $t>1$ CASE 2 $t-3>0$ AND $t-1<0$ $t>3$ $\quad$ $t<1$ The answer is the first case, $1 \leq t \leq 3$. The second case is not possible, as t cannot be both greater than 3 and less than 1.

REF: 010231b

3 ANS:
$20 < x < 100$

$-x^2 + 120x - 2000 > 0$ $x^2 - 120x + 2000 < 0$ $(x-100)(x-20) < 0$ For the product of these binomials to be negative, either: 1. $(x-100)$ must be negative AND $(x-20)$ must be positive; or 2. $(x-100)$ must be positive AND $(x-20)$ must be negative	CASE 1 $x - 100 < 0$ AND $x - 20 > 0$ $x < 100$ $\quad$ $x > 20$ CASE 2 $x - 100 > 0$ AND $x - 20 < 0$ $x > 100$ $\quad$ $x < 20$ The answer is the first case, $20 < x < 100$. The second case is not possible, as x cannot be both greater than 100 and less than 20.



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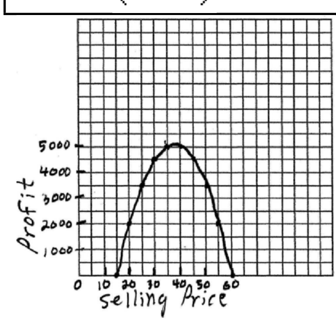
4 ANS:
$15 < x < 60$

$-10x^2 + 750x - 9000 > 0$ $x^2 - 75x + 900 < 0$ $(x-60)(x-15) < 0$ For the product of these binomials to be negative, either: 1. $(x-60)$ must be negative AND $(x-15)$ must be positive; or 2. $(x-60)$ must be positive AND $(x-15)$ must be negative	CASE 1 $x - 60 < 0$ AND $x - 15 > 0$ $x < 60$ $\quad$ $x > 15$ CASE 2 $x - 60 > 0$ AND $x - 15 < 0$ $x > 60$ $\quad$ $x < 15$ The answer is the first case, $15 < x < 60$. The second case is not possible, as x cannot be both greater than 60 and less than 15.



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5 ANS:

$$-2x^2 + 38x + 10 \geq 125$$
$$-2x^2 + 38x - 115 \geq 0$$

$3.8 \leq x \leq 15.2.$

$$\frac{-38 \pm \sqrt{38^2 - 4(-2)(-115)}}{2(-2)}$$
$$\frac{-38 \pm 22.89}{-4}$$
$$\frac{-38 + 22.89}{-4} \approx 3.8 \quad \frac{-38 - 22.89}{-4} \approx 15.2$$
$$3.8 \leq x \leq 15.2$$

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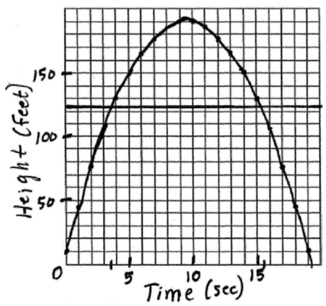

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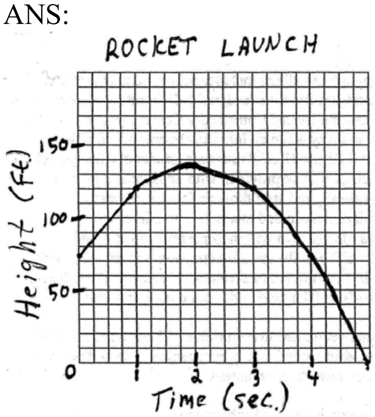
6 ANS:



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