

I. When a quadratic function is in standard form $f(x) = ax^2 + bx + c$, it can be put into vertex form $f(x) = a(x-h)^2 + k$ using the method of *completing the square* that was shown in class. You will be expected to be able to do this for quadratic functions in which $a = 1$.

1. $f(x) = x^2 - 6x + 4$

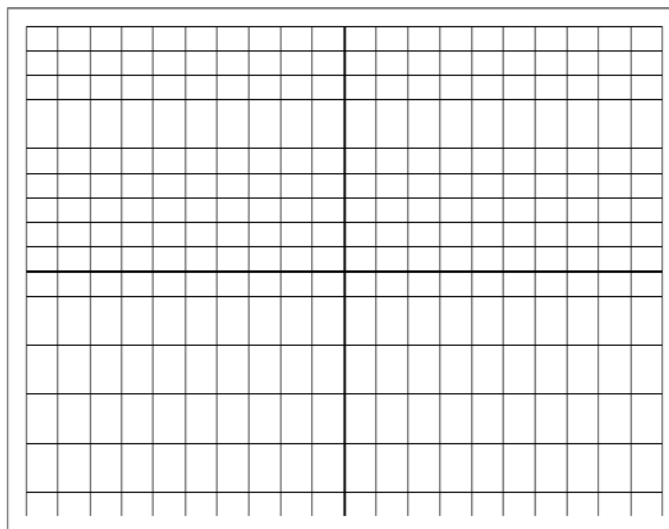
(a) Complete the square to put this function into vertex form

(b) State the direction of opening.

(c) State the coordinates of the vertex.

(d) Find the y-intercept.

(e) Sketch the graph. **DO NOT USE YOUR CALCULATOR.**



(f) State the domain

(g) State the range

II. A quadratic function in standard form $y = f(x) = ax^2 + bx + c$, where a , b , and c are real numbers and $a \neq 0$ is always a parabola which opens upward if $a > 0$ and downward if $a < 0$.

The **vertex** or turning point of the parabola occurs when $x = -\frac{b}{2a}$ and $y = f(-\frac{b}{2a})$.

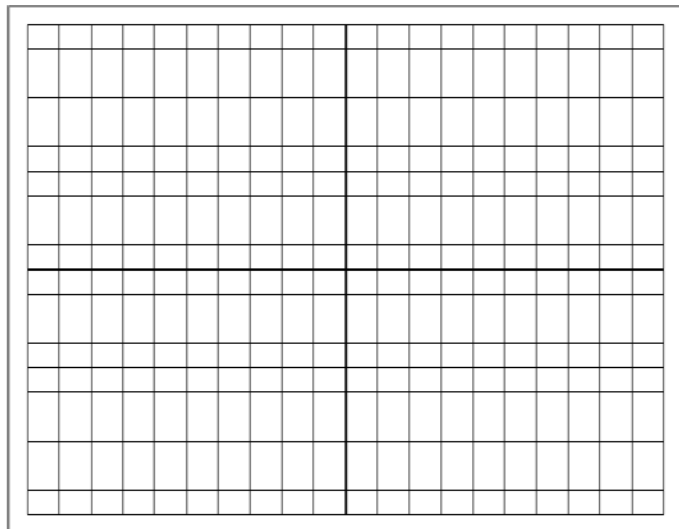
The **axis of symmetry** is the vertical line through the vertex. Its equation is $x = -\frac{b}{2a}$.

The **y-intercept** occurs when $x = 0$. To find it, substitute $x = 0$ into the equation and find the corresponding value of y .

The **x-intercepts** occur when $y = 0$. To find the x-intercepts, set $y = f(x) = ax^2 + bx + c = 0$ and solve for x by factoring or by using the quadratic formula.

2. $f(x) = 2x^2 - 5x - 3$

- (a) State the direction of opening.
- (b) Find the coordinates of the vertex.
- (c) Find the y-intercept.
- (d) Find the x-intercepts



- (e) Sketch the graph

- (f) State whether the function has a maximum or a minimum value and find that maximum or minimum.

3. $h(x) = -3x^2 + 18x + 11$

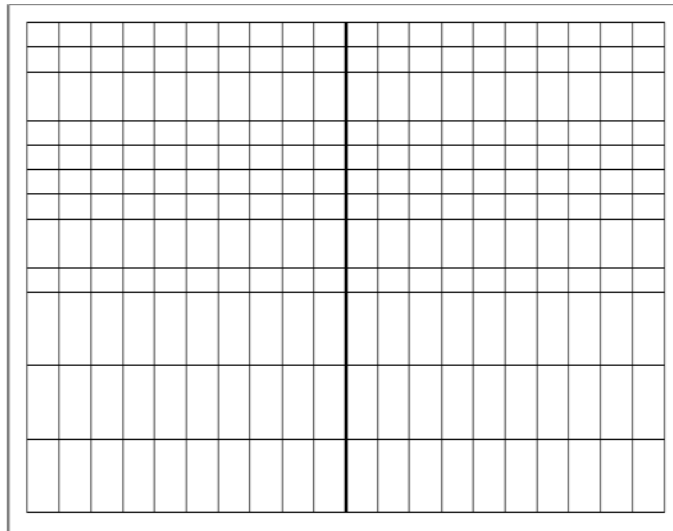
(a) State the direction of opening .

(b) Find the coordinates of the vertex.

(c) Find the y-intercept.

(d) Find the x-intercepts

(e) Sketch the graph.



(f) State whether the function has a maximum or a minimum value and find that maximum or minimum.

5. If an object is tossed downward with an initial speed (velocity) of v_0 , then it will travel a distance of s meters, where $s = 4.9t^2 + v_0t$ and t is measured in seconds.
- (a) Suppose an object is tossed downward with an initial speed of 40 m/sec.
- (i) How far will it travel in 2 seconds?
- (ii) After how many seconds will the object have traveled 200 meters?
- (b) Suppose an object falls from a helicopter that has an altitude of 400 m. How long will it take for the object to hit the ground?
6. The number of inmates in custody in US prisons and jails can be modeled by the quadratic function $p(x) = -x^2 + 93x + 1128$, where $p(x)$ is the number of inmates in thousands, and x is the number of years after 1990.
- (a) According to this model, in what year will the number of prison and jail inmates in custody in the United States be at its maximum?
- (b) What is that maximum number of inmates?

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7. The function $p = f(x) = 0.0111x^2 - 1.32x + 48.24$ approximates the percentages of Californians who are foreign born, where x represents the number of years since 1900.
- (a) What was the percentage of foreign-born Californians in 1940?
- (b) In what year or years were 15% of Californians foreign-born?
- (c) In what year was the percentage of Californians who are foreign-born the lowest? What is the lowest percentage?

Answers

1. (a) $f(x) = (x-3)^2 - 5$ (b) up (c) (3, -5) (d) (0,4) (f) $(-\infty, \infty)$ (g) $[-5, \infty)$
2. (a) up (b) (1.25, -6.125) (c) (0, -3) (d) $(-1/2, 0)$ and (3,0) (f) Minimum of -6.125
3. (a) down (b) (3, 38) (c) (0, 11) (d) $(-.56, 0)$ and (6.56,0) (f) Maximum of 38
4. (a) -1100 The company will have a loss of \$1100 if no items are manufactured and sold.
 (b) 63 items (c) \$2869 (d) $[0, 150] \times [-2000, 3000]$ (e) 27 or 99 items (f) 9 or 117 items
5. (a) (i) 99.6 meters (ii) 3.5 seconds (b) about 9 seconds
6. (a) 2036 or 2037 (b) 3,290,250
7. (a) 13.2% (b) 1936 and 1983 (c) 1959; 9%