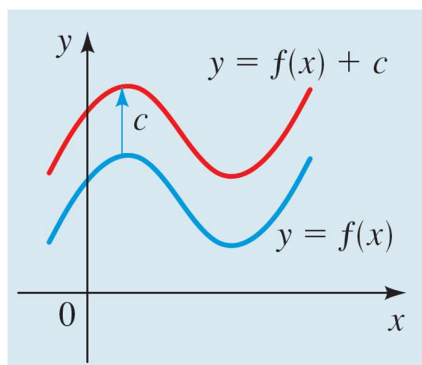


Section 2.6 – Transformations of Functions

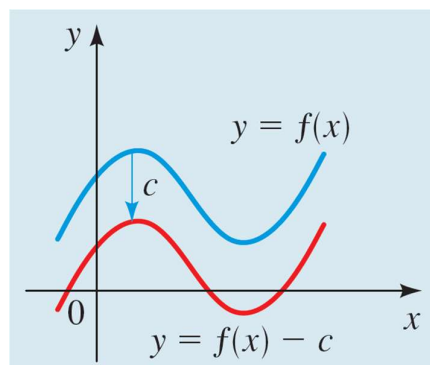
- Adding a constant to a function shifts its graph **vertically**

عند إضافة ثابت (رقم) للدالة يتسبب في تحرك رسم الدالة عمودياً



إذا قمنا بإضافة رقم **موجب**:

تتحرك الرسمة لأعلى. ↑



إذا قمنا بإضافة رقم **سالب**:

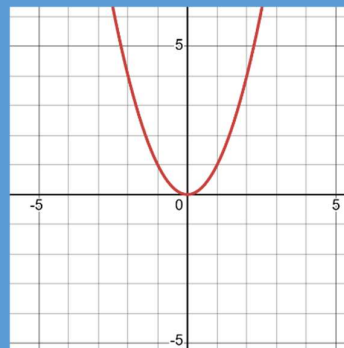
تتحرك الرسمة لأسفل. ↓

Example 1

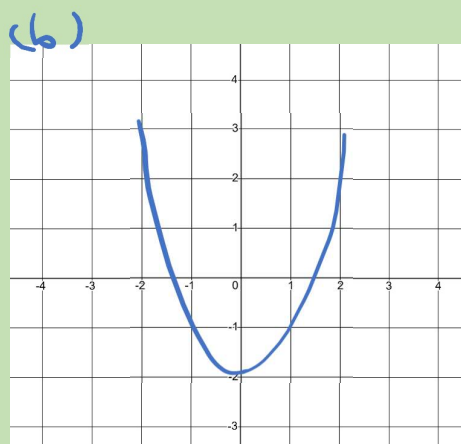
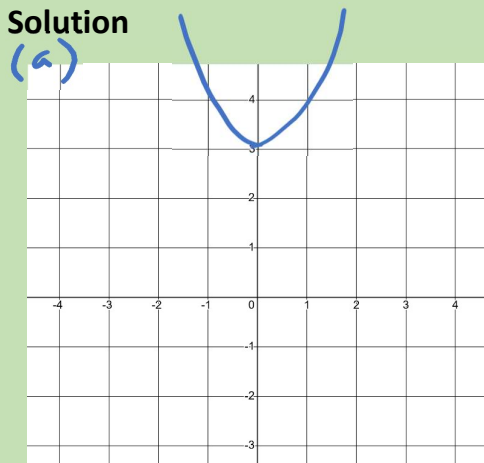
Use the graph of $f(x) = x^2$ to sketch the graph of each function.

(a) $g(x) = x^2 + 3$

(b) $h(x) = x^2 - 2$

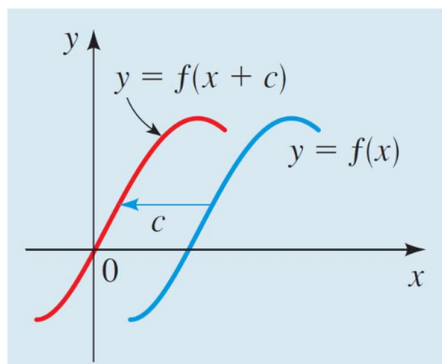


Solution



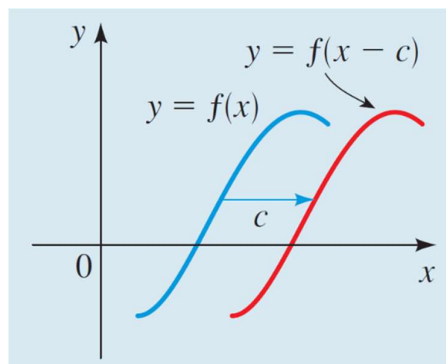
- Adding a constant to the variable of the function shifts its graph **horizontally**

عند إضافة ثابت إلى المتغير داخل الدالة يتحرك رسم الدالة أفقياً



إذا قمنا بإضافة رقم **موجب**:

تتحرك الرسمة لليسار. ←



إذا قمنا بإضافة رقم **سالب**:

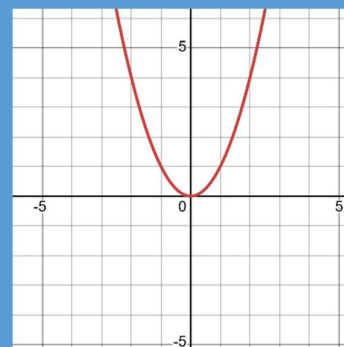
تتحرك الرسمة لليمين. →

Example 2

Use the graph of $f(x) = x^2$ to sketch the graph of each function.

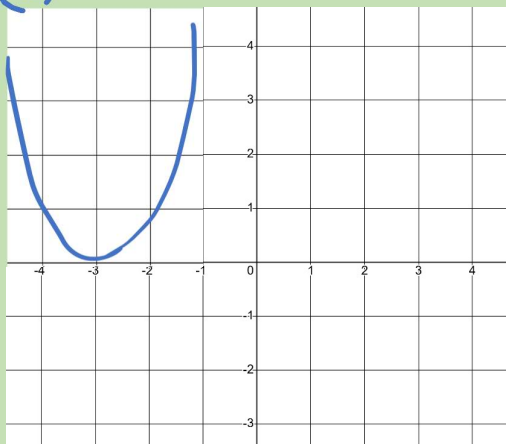
(a) $g(x) = (x + 3)^2$

(b) $h(x) = (x - 2)^2$

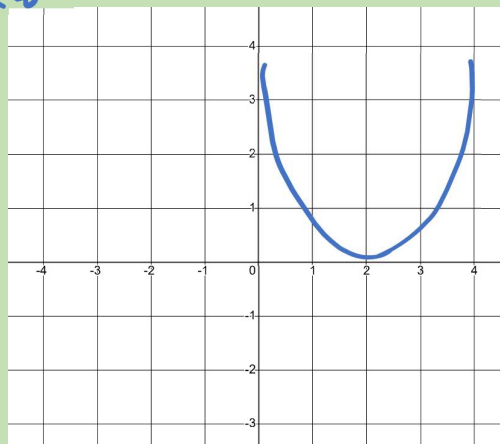


Solution

(أ)

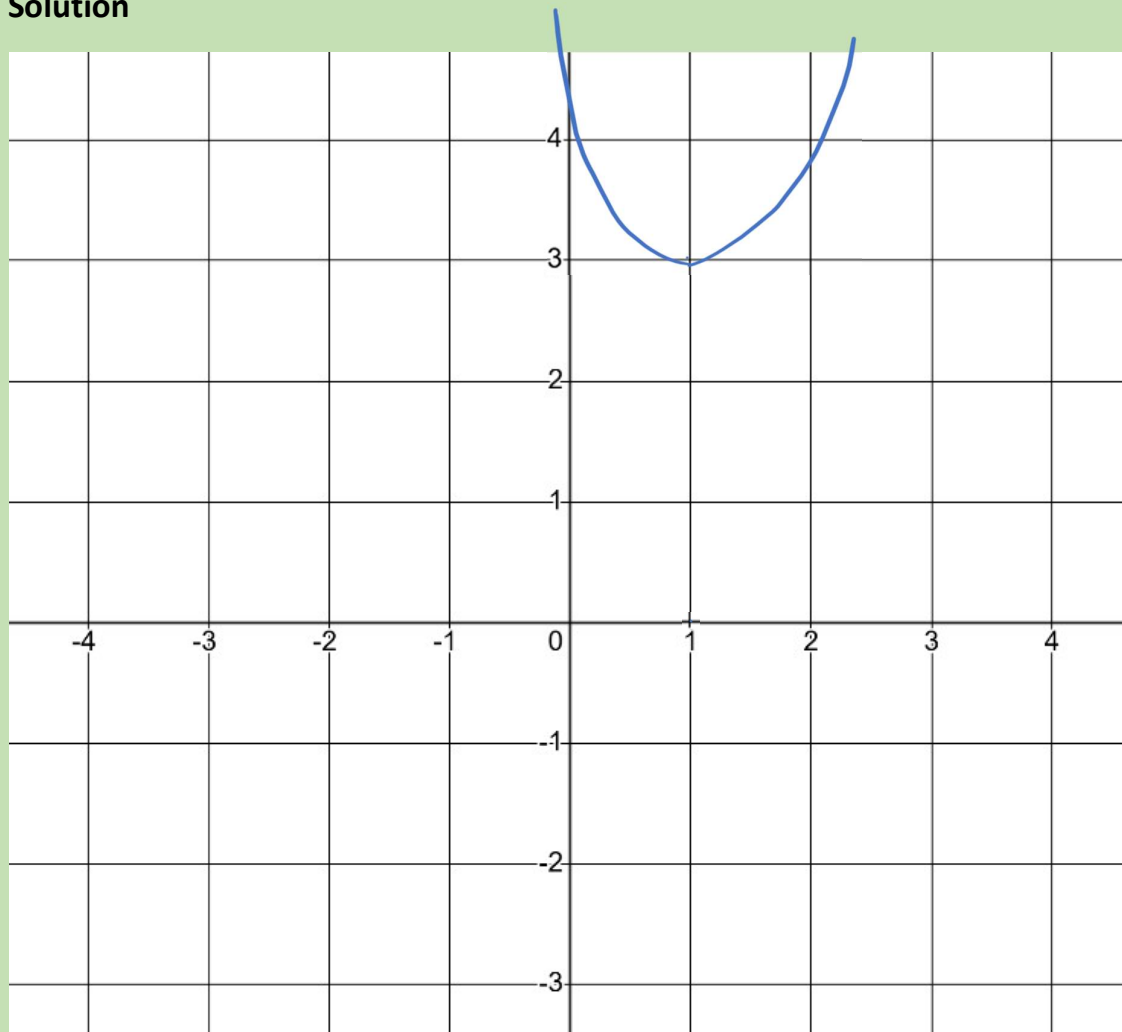


(ب)



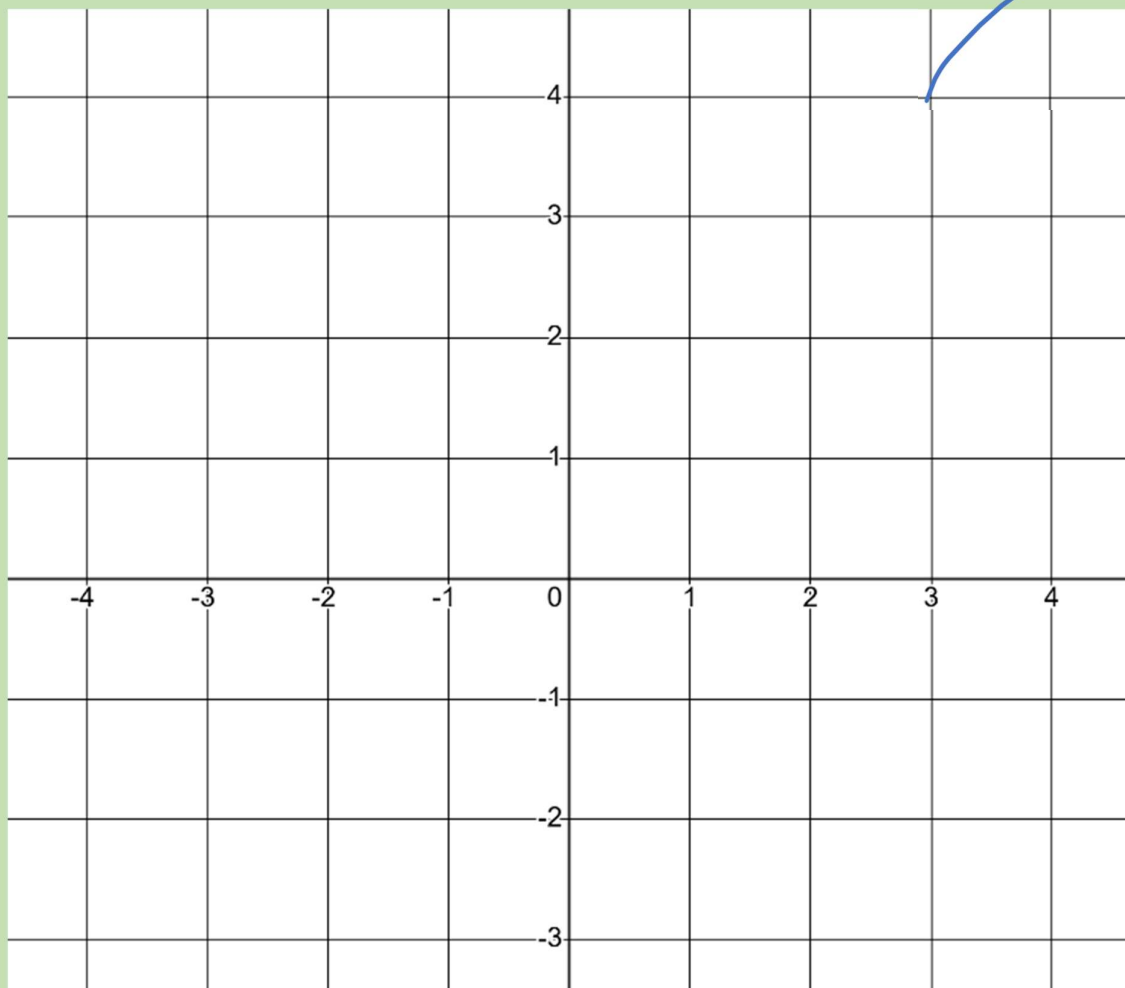
Example 3

Sketch the graph of $f(x) = (x - 1)^2 + 3$

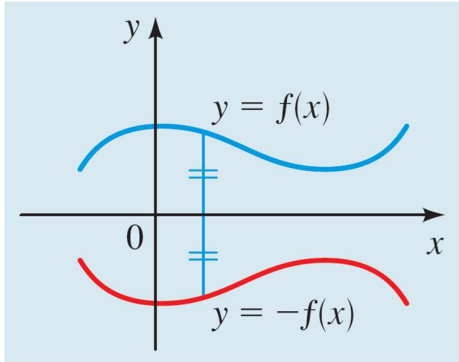
Solution

Example 4

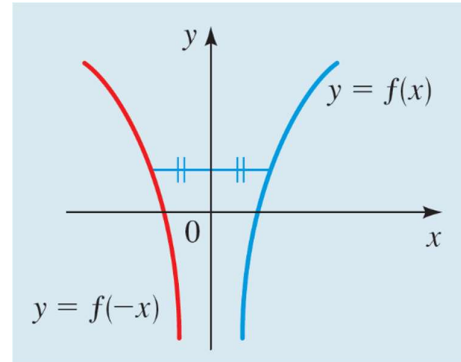
Sketch the graph of $f(x) = \sqrt{x - 3} + 4$

Solution

- Changing the sign الإشارة of the whole function " $y = -f(x)$ " results in graph reflection about x -axis, and changing the sign of the variable of the function " $y = f(-x)$ " reflects the graph about y -axis



تغيير إشارة الدالة يعكس الرسم
حول x -axis



تغيير إشارة متغير الدالة يعكس
الرسم حول y -axis

Example 5

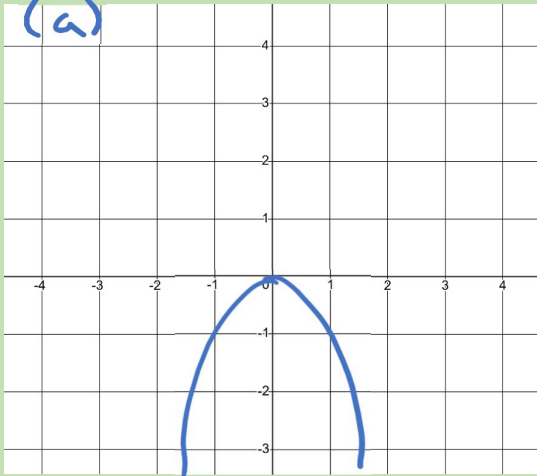
Sketch the graph of each function.

(a) $f(x) = -x^2$

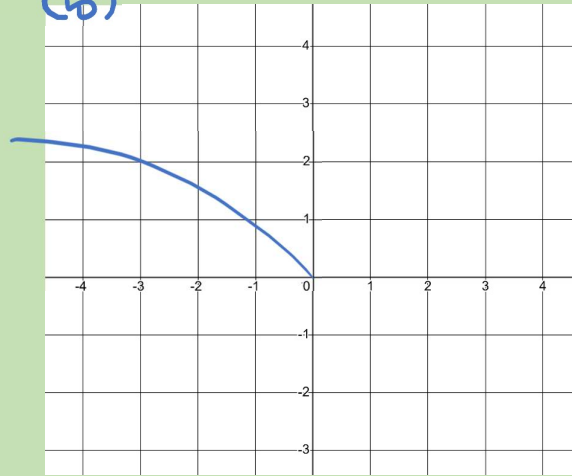
(b) $g(x) = \sqrt{-x}$

Solution

(a)



(b)

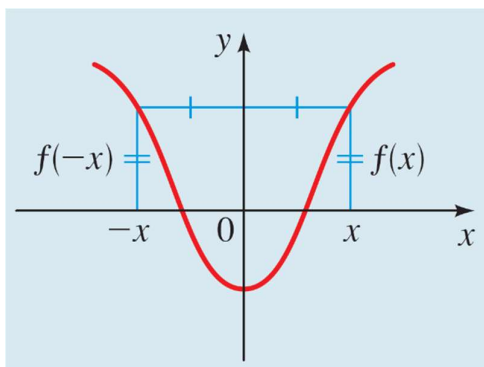


- A function is **even** زوجية if $f(-x) = f(x)$

A function is **odd** فردية if $f(-x) = -f(x)$

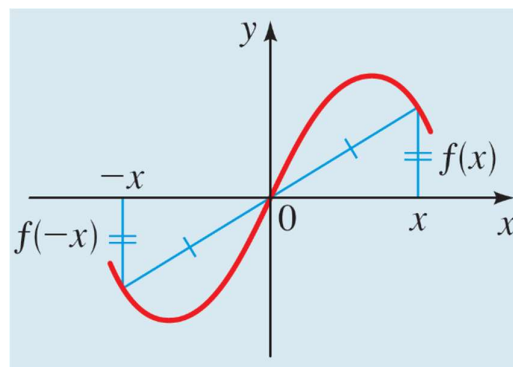
الدالة الزوجية: دالة لا تتغير بتغير إشارة متغير الدالة

الدالة الفردية: تنعكس إشارة الدالة بالكامل بتغير إشارة متغير الدالة



الدالة الزوجية: لاحظ تماثل الرسم

حول y-axis



الدالة الفردية: لاحظ تماثل الرسم

حول origin (نقطة الأصل)

Example 6

Determine whether the functions are even, odd, or neither even nor odd.

(a) $f(x) = x^5 + x$

(b) $g(x) = 1 - x^4$

(c) $h(x) = 2x - x^2$

Solution

$$\begin{aligned} \text{(a)} \quad f(-x) &= (-x)^5 + (-x) \\ &= -x^5 - x \\ &= -(x^5 + x) = -f(x) \quad \therefore \text{odd} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad g(-x) &= 1 - (-x)^4 \\ &= 1 - x^4 = g(x) \quad \therefore \text{even} \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad h(-x) &= 2(-x) - (-x)^2 \\ &= -2x - x^2 \end{aligned}$$

Neither even nor odd

Problems

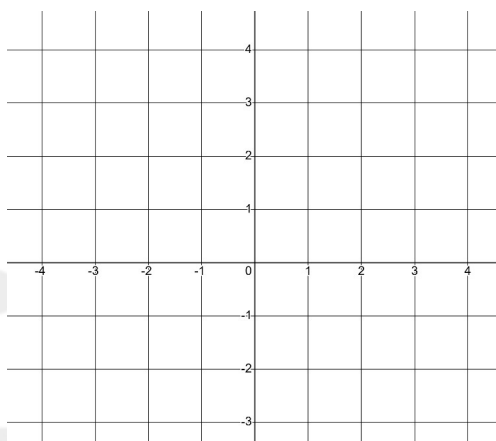
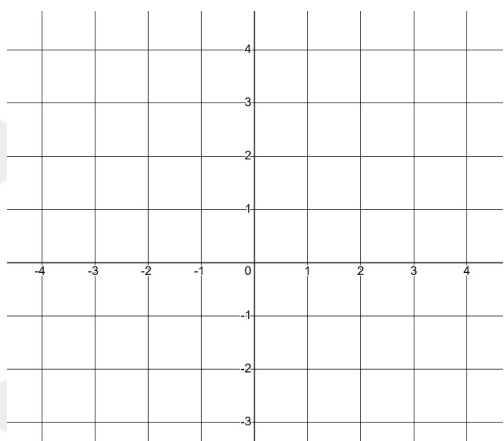
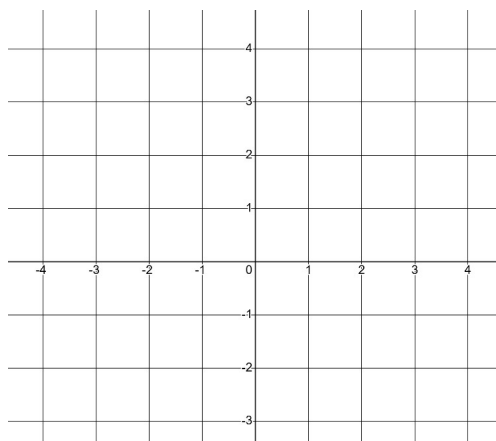
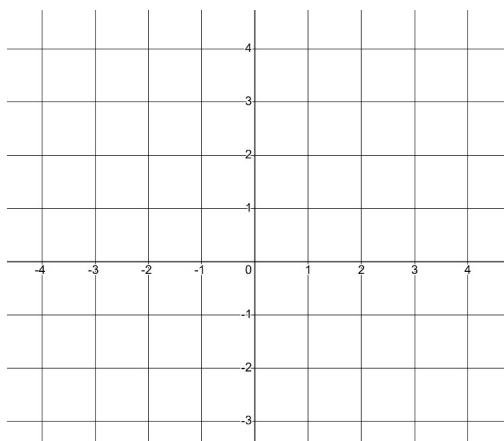
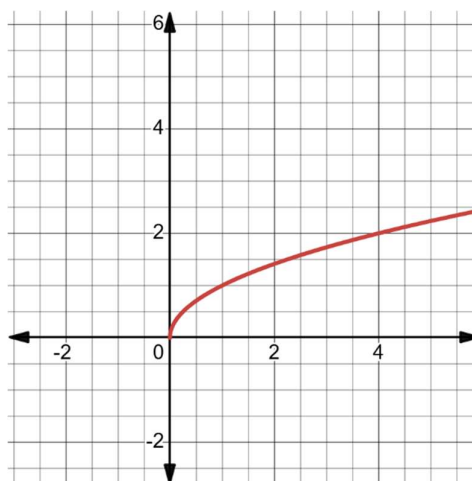
- Use the graph of $y = \sqrt{x}$ to graph the following.

(a) $g(x) = \sqrt{x - 2}$

(b) $g(x) = \sqrt{x} + 1$

(c) $g(x) = \sqrt{x + 2} + 2$

(d) $g(x) = -\sqrt{x} + 1$



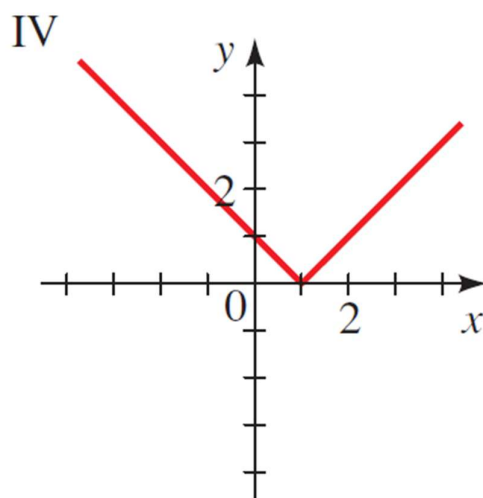
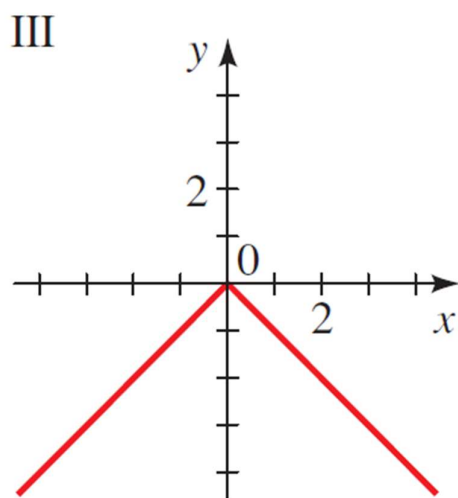
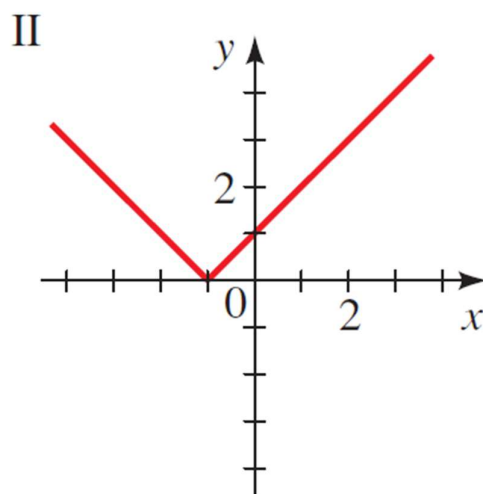
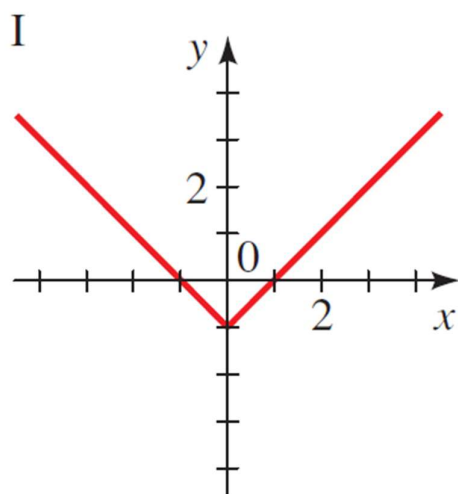
- Match the graph with the function.

(a) $y = |x + 1|$

(b) $y = |x - 1|$

(c) $y = |x| - 1$

(d) $y = -|x|$



- Sketch the graph of the function by starting with the graph of a standard function and applying transformations.

(a) $f(x) = x^2 + 3$

(b) $f(x) = (x - 5)^2$

