

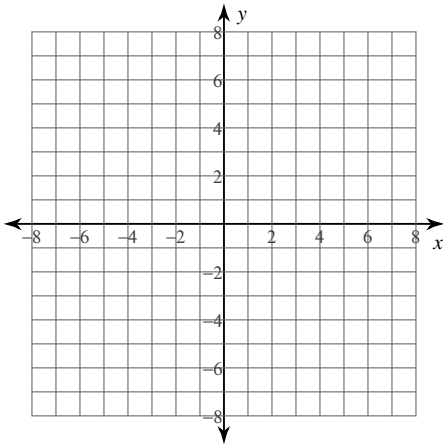
function families

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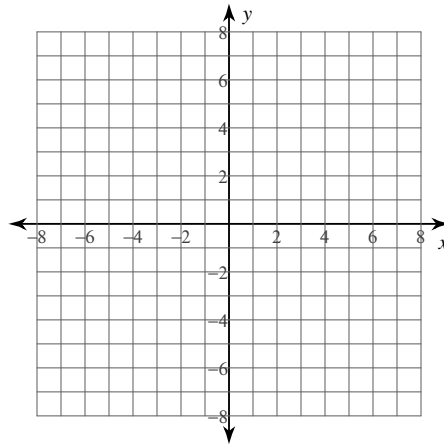
Date _____ Period _____

Sketch the graph of each function.

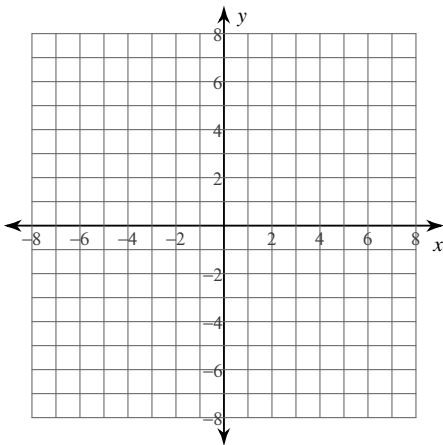
1) $y = \sqrt{x} + 4$



2) $y = \sqrt{x} - 2$



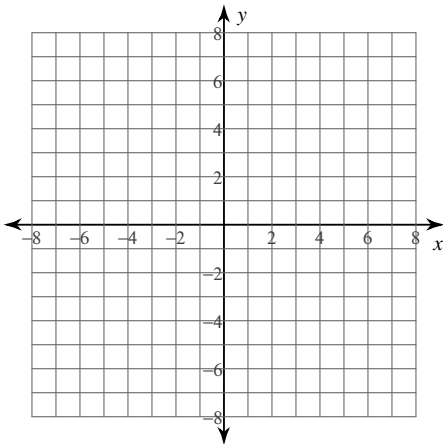
3) $y = \sqrt{x} + 3$



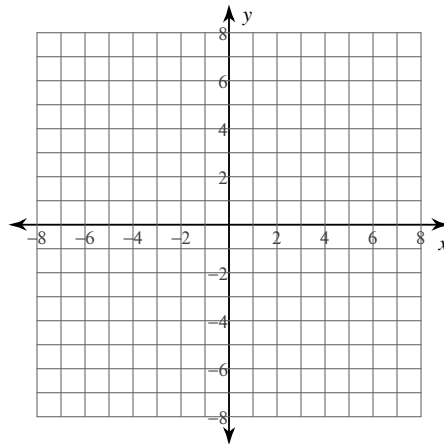
4) $y = -3 + \sqrt{x}$



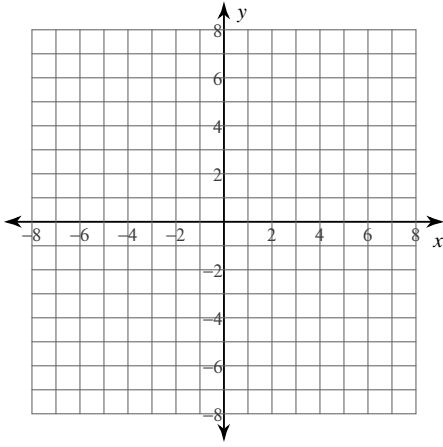
5) $y = \sqrt{x} + 2$



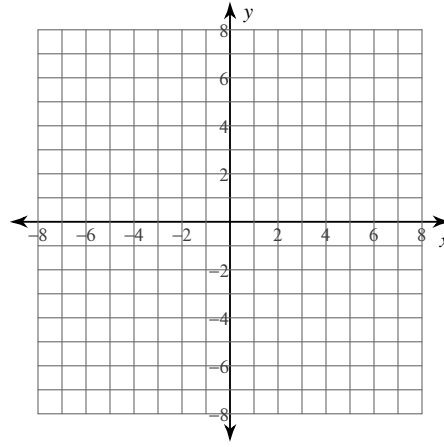
6) $y = \sqrt{x} - 4$



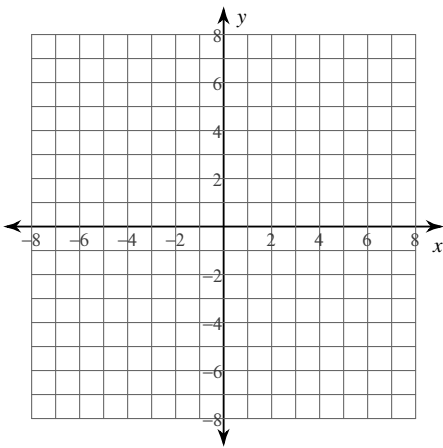
7) $y = \sqrt{x} - 5$



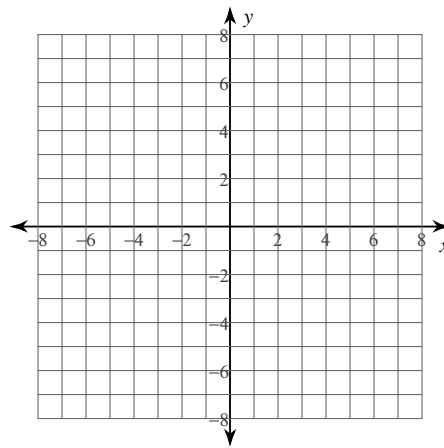
8) $y = \sqrt{x} + 5$



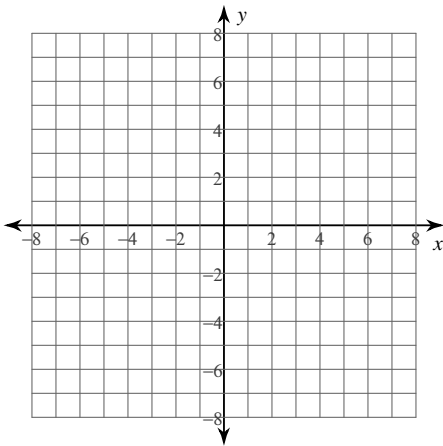
9) $y = -1 + \sqrt{x}$



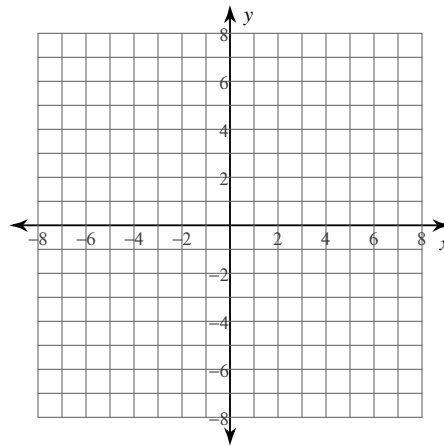
10) $y = 1 + \sqrt{x}$



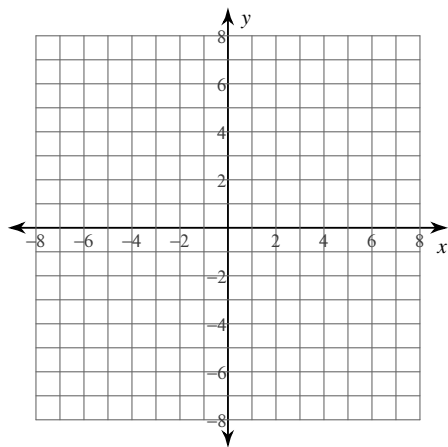
11) $y = \sqrt{x} - 1$



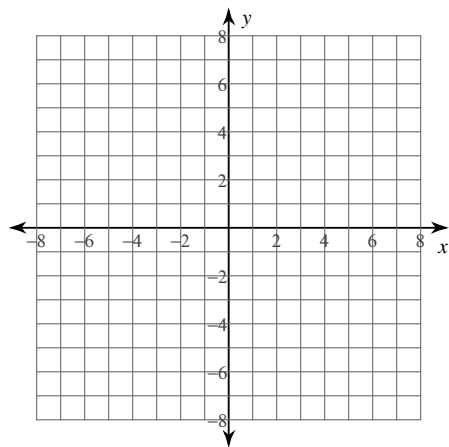
12) $y = \sqrt{x} + 5$



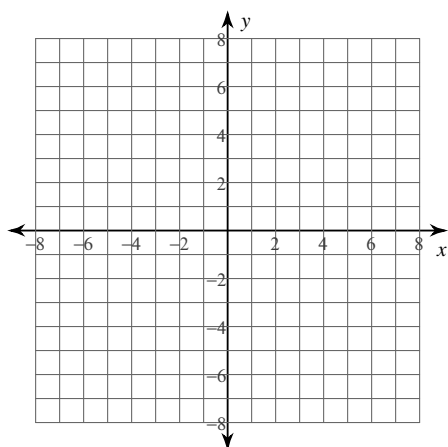
13) $y = \sqrt{x} + 4$



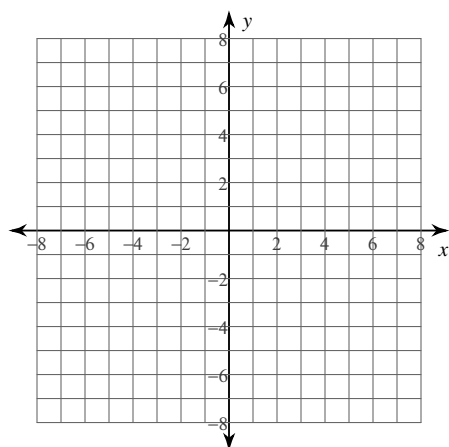
14) $y = -4 + \sqrt{x}$



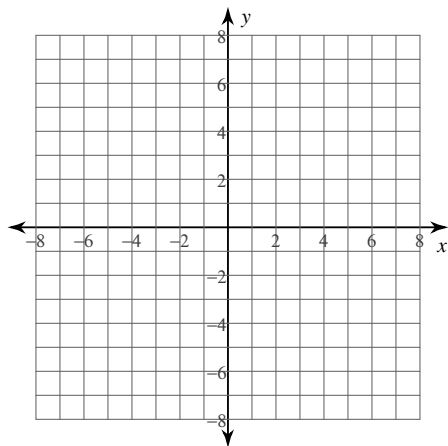
15) $y = -5 + \sqrt{x}$



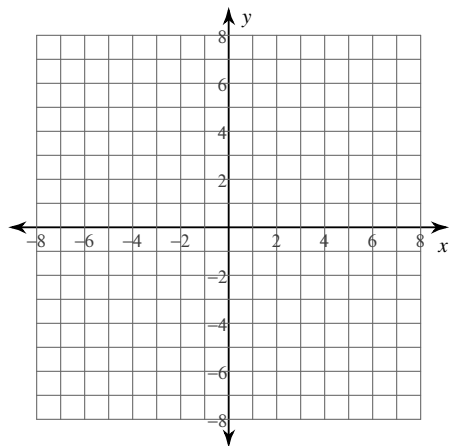
16) $y = \sqrt{x} - 3$



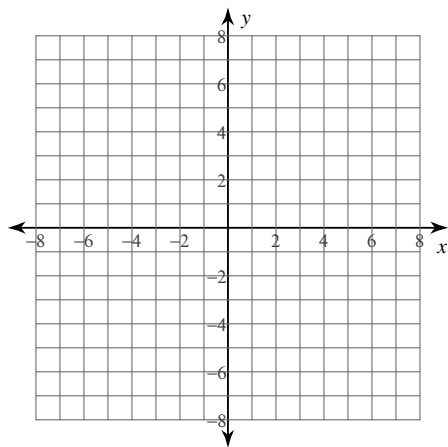
17) $y = \sqrt{x} + 1$



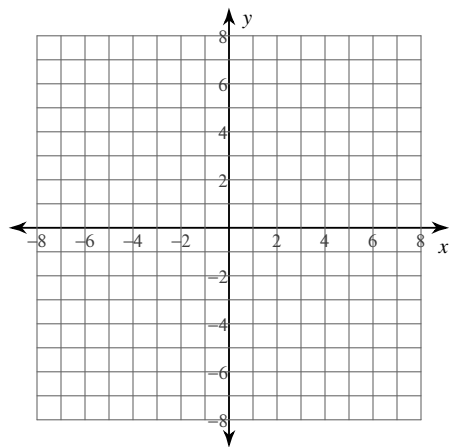
18) $y = -2 + \sqrt{x}$



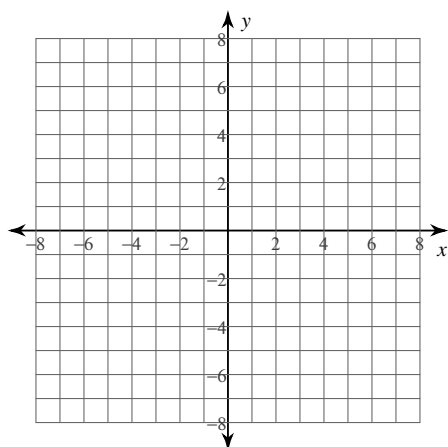
19) $y = \sqrt{x} + 3$



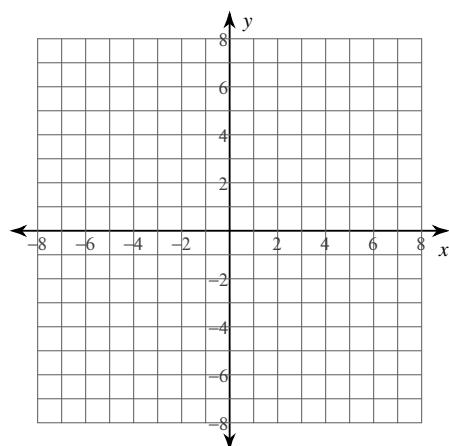
20) $y = 2 + \sqrt{x}$



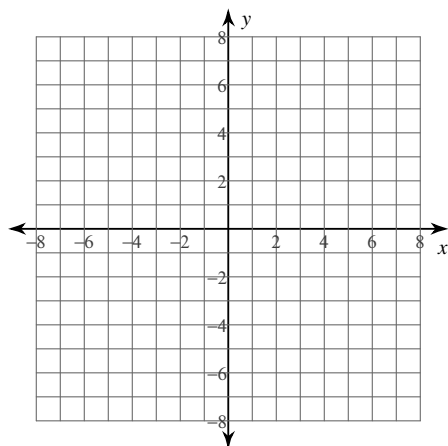
21) $y = \sqrt{x} - 5$



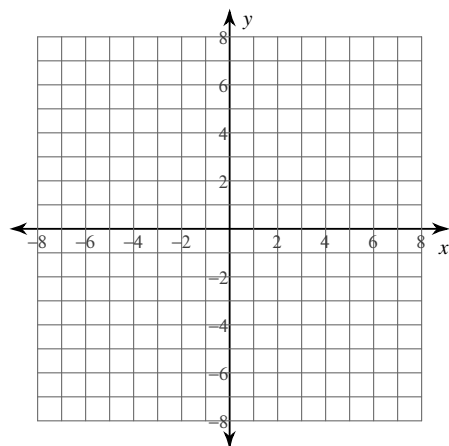
22) $y = \frac{1}{2}\sqrt{x}$



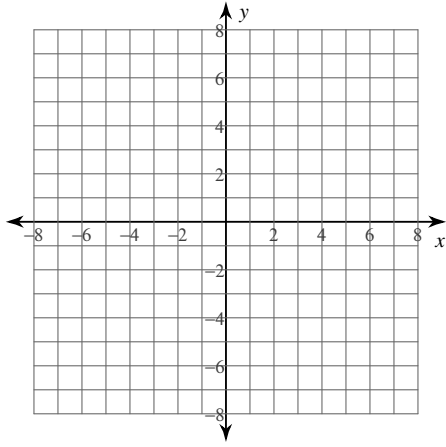
23) $y = \sqrt{x+4}$



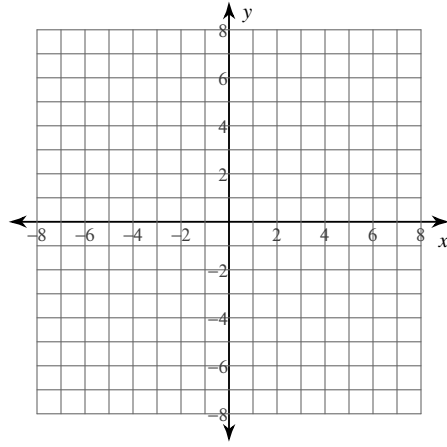
24) $y = \sqrt{x+6}$



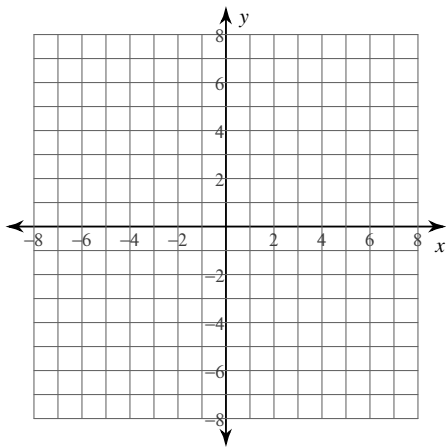
$$25) y = \sqrt{x+5} - 1$$



$$26) y = \sqrt{x+3} + 3$$

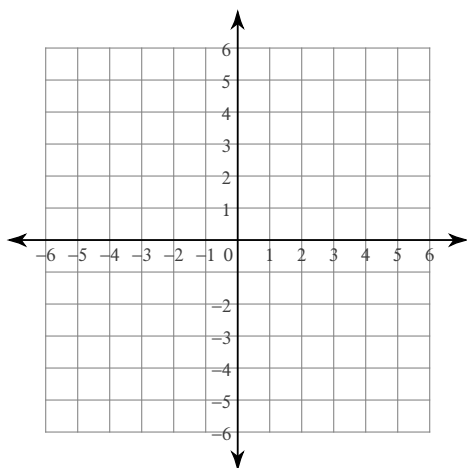


$$27) y = \sqrt{x} - 2$$

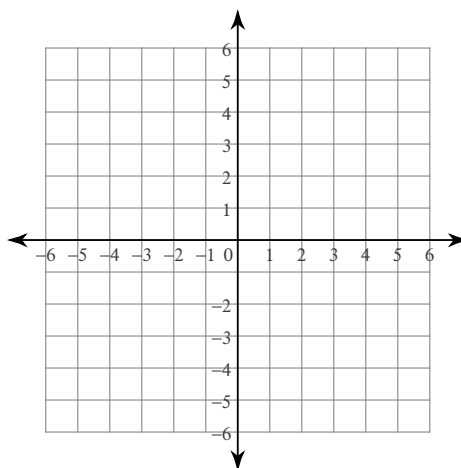


Graph each equation.

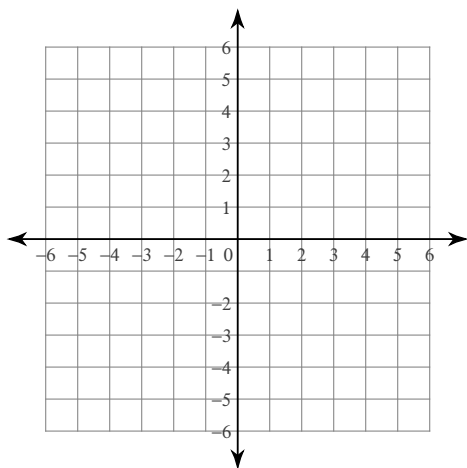
28) $y = |x + 3|$



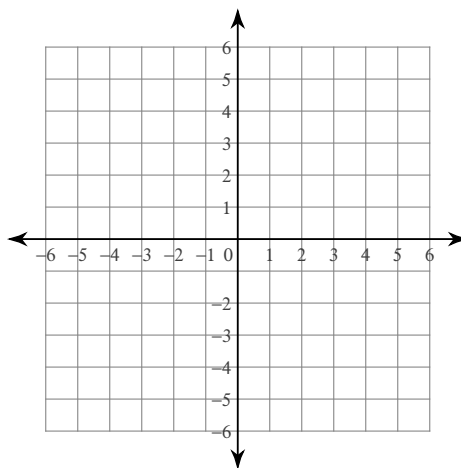
29) $y = |x - 4|$



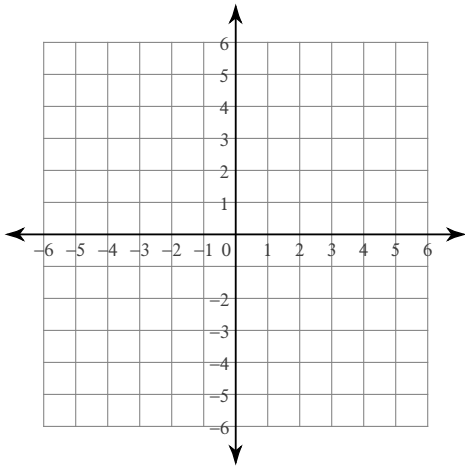
30) $y = |x + 1|$



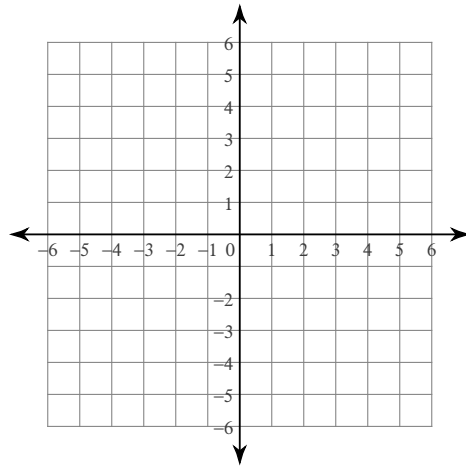
31) $y = |x - 2|$



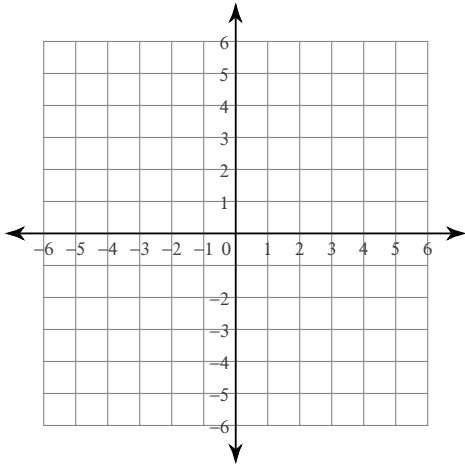
$$32) y = |x - 3|$$



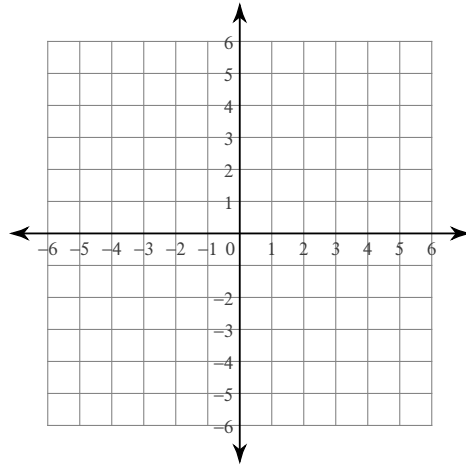
$$33) y = |x| + 3$$



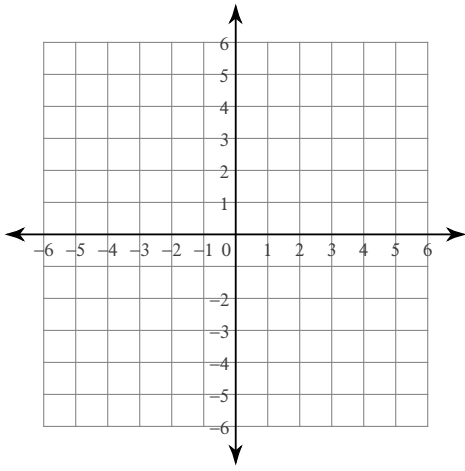
$$34) y = |x| - 4$$



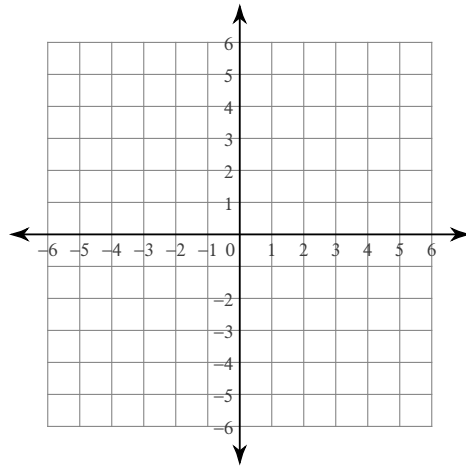
$$35) y = |x| - 1$$



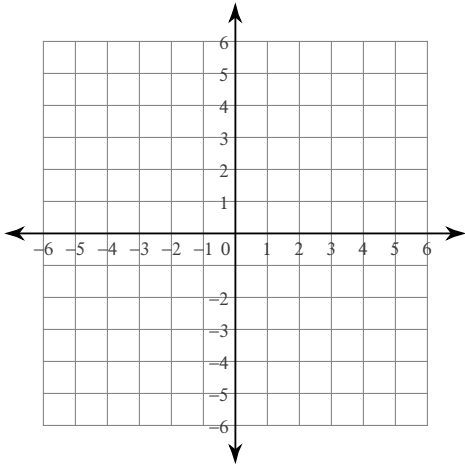
$$36) y = |x| + 1$$



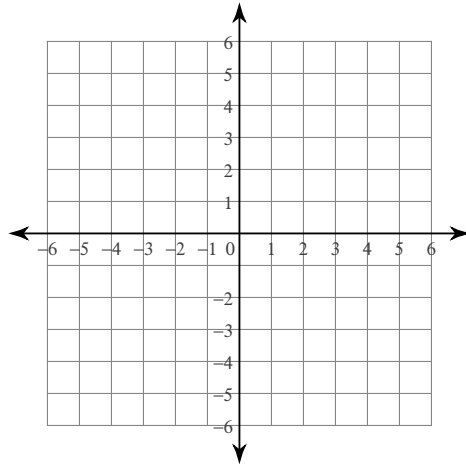
$$37) y = |x| + 2$$



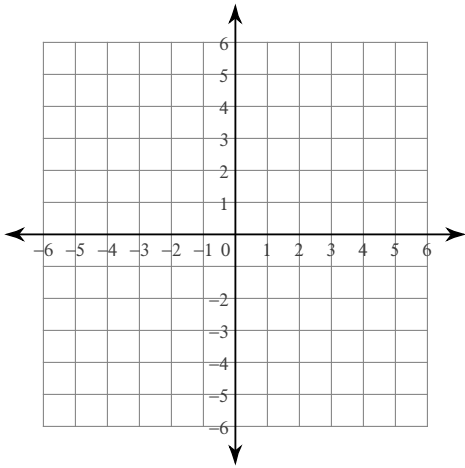
$$38) y = |x + 2| + 1$$



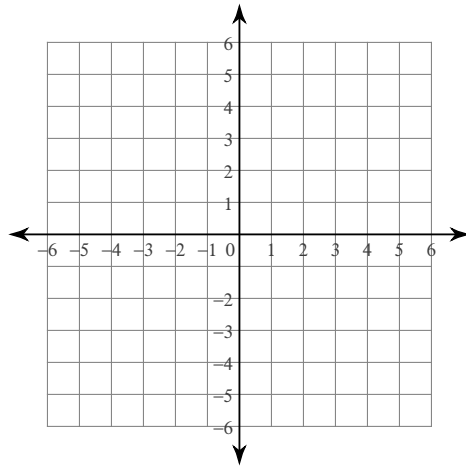
$$39) y = |x + 2| - 4$$



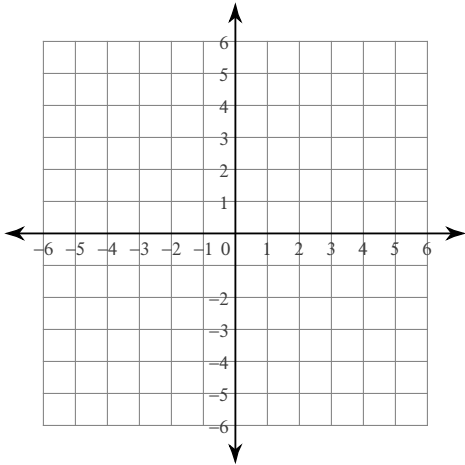
$$40) y = |x - 1| - 3$$



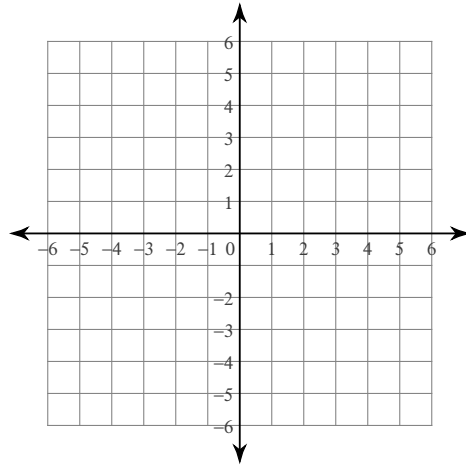
$$41) y = |x + 2| - 1$$



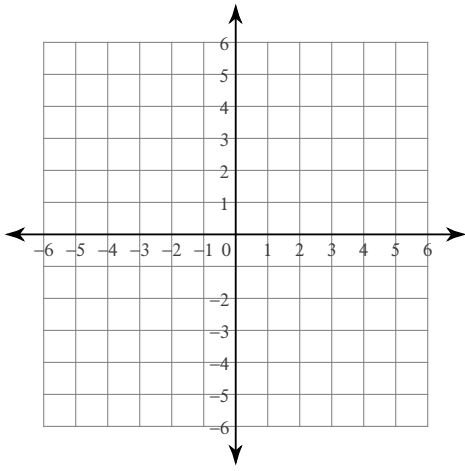
$$42) y = |x + 3| - 1$$



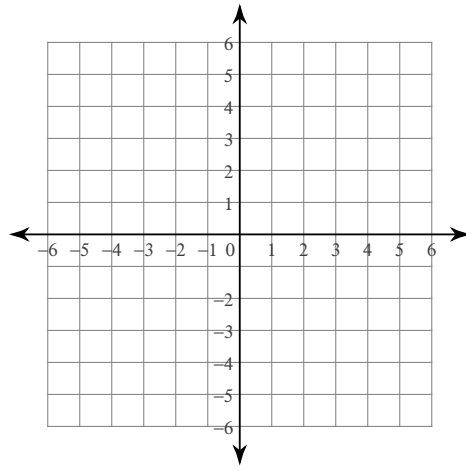
$$43) y = |x| + 2$$



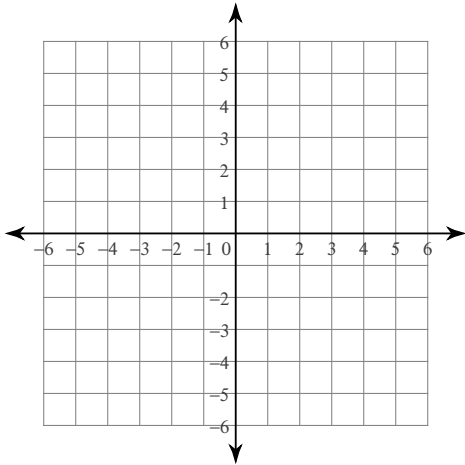
$$44) y = |x - 2|$$



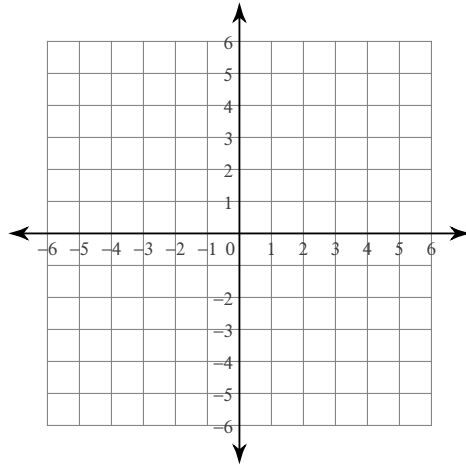
$$45) y = |x| + 4$$



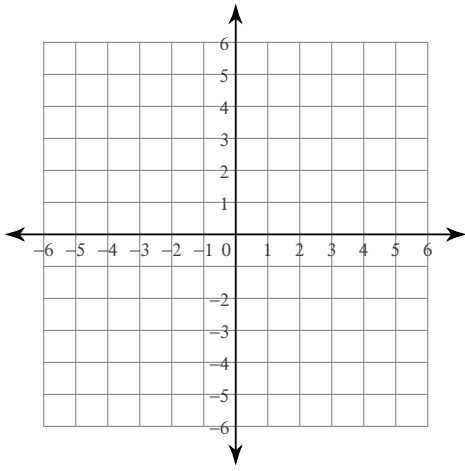
$$46) y = |x| + 1$$



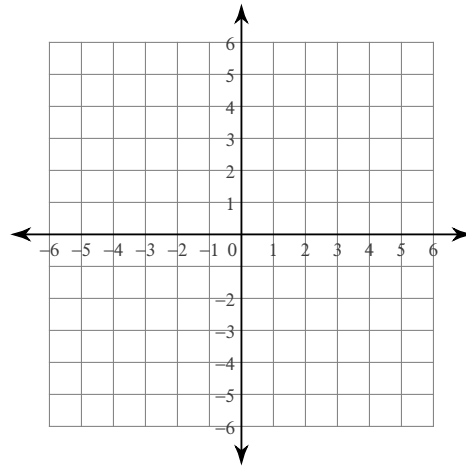
$$47) y = |x - 4| - 1$$



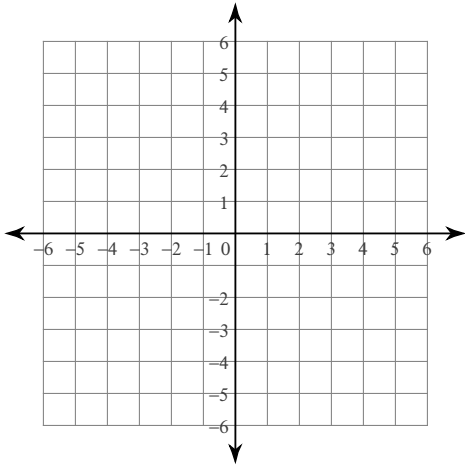
$$48) y = |x - 3|$$



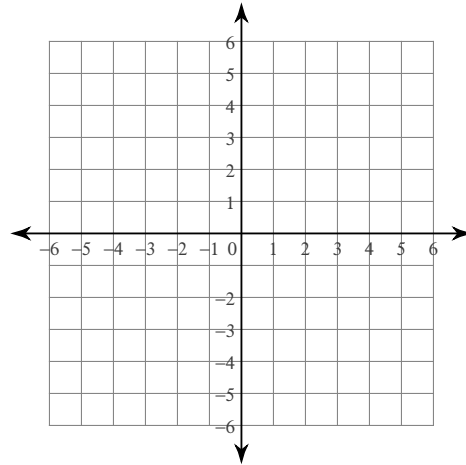
$$49) y = |x + 4| - 2$$



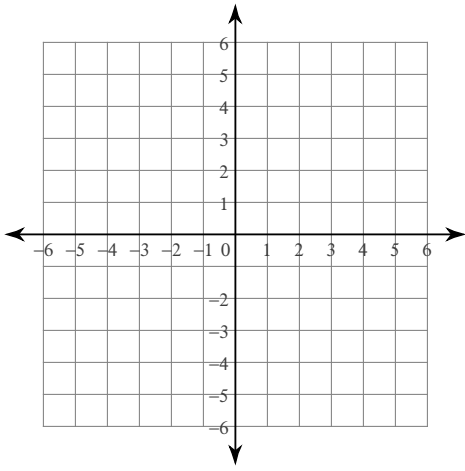
$$50) y = |x - 1| - 2$$



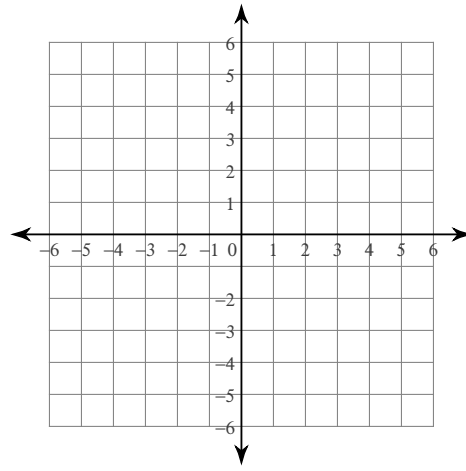
$$51) y = -|x - 1|$$



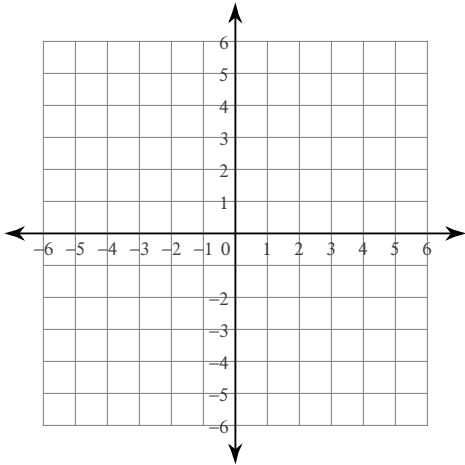
$$52) y = -|x| + 1$$



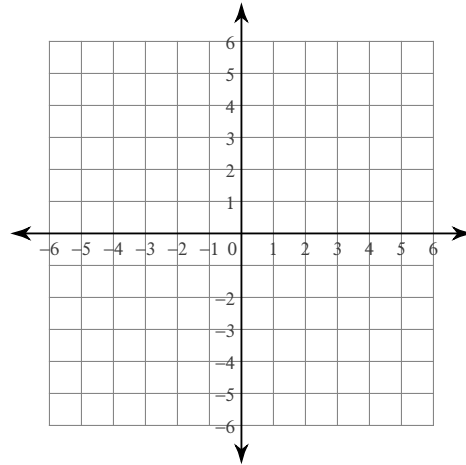
$$53) y = -|x - 2|$$



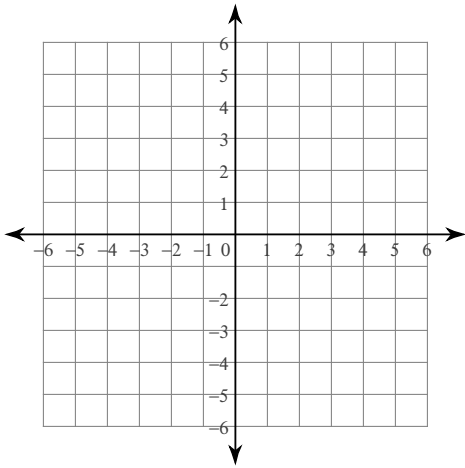
$$54) y = -|x| - 4$$



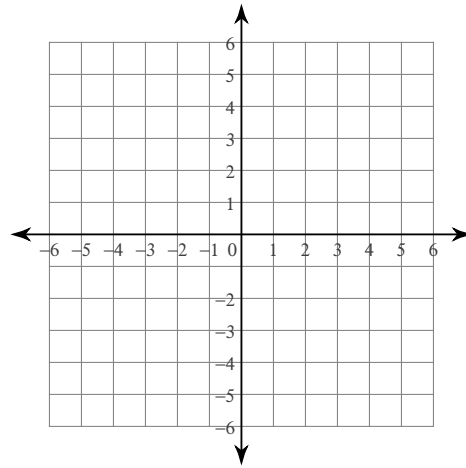
$$55) y = |x + 3| - 2$$



56) $y = -|x| - 2$

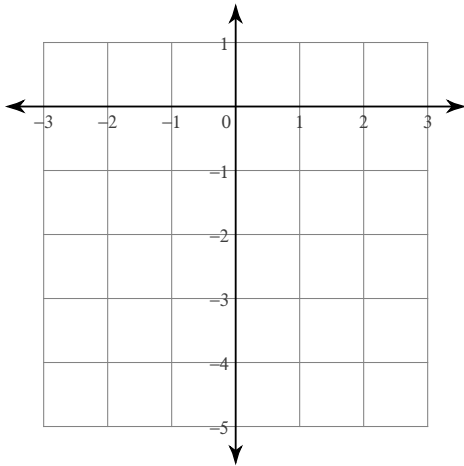


57) $y = |x + 1| - 3$

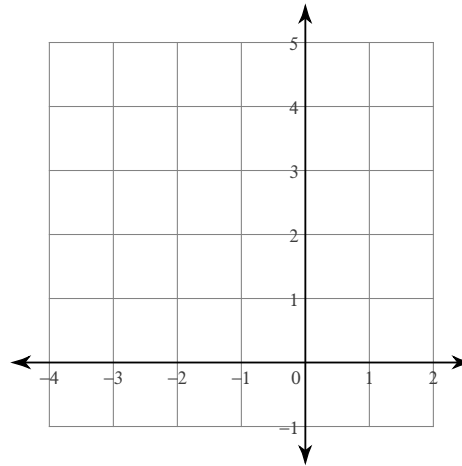


Sketch the graph of each function.

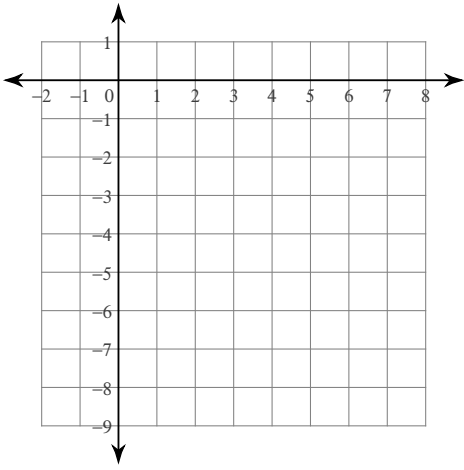
58) $y = -x^2$



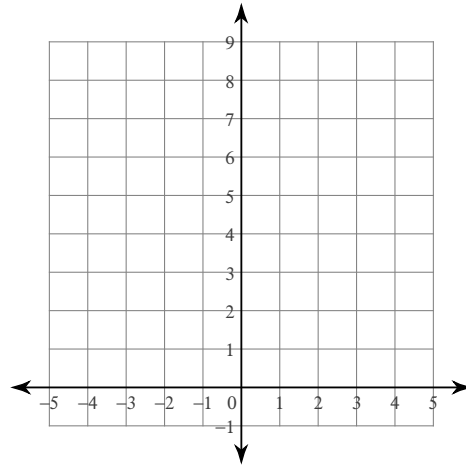
59) $y = x^2$



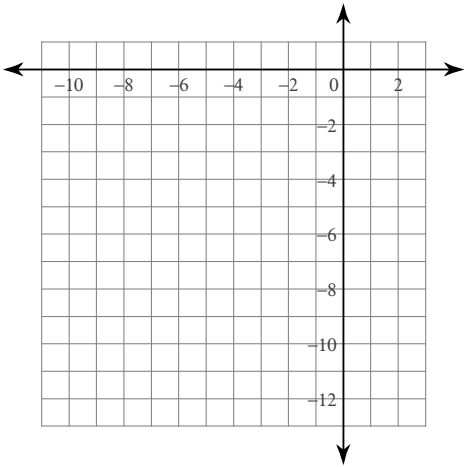
60) $y = -2x^2$



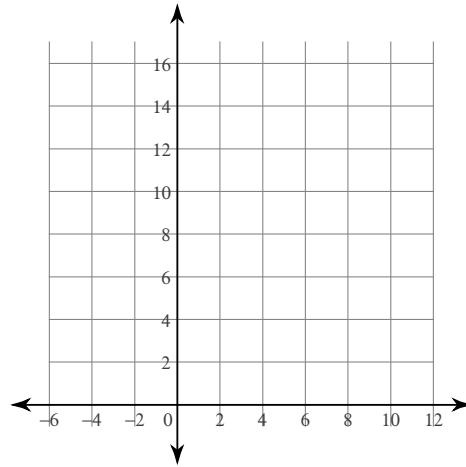
61) $y = 2x^2$



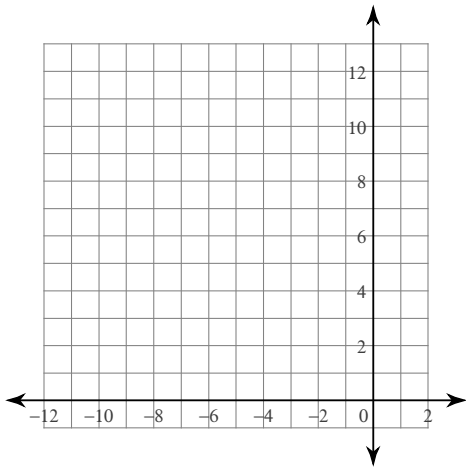
62) $y = -3x^2$



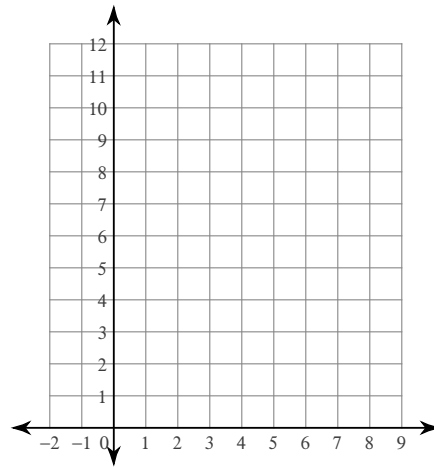
63) $y = 4x^2$



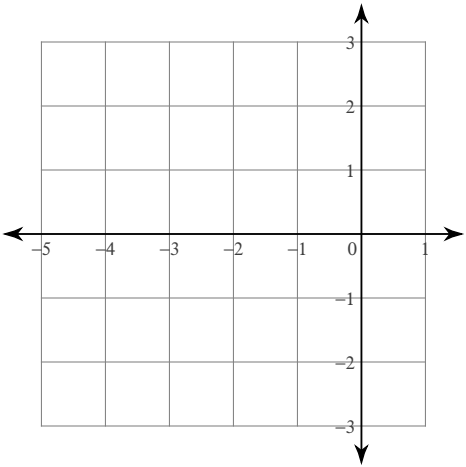
64) $y = 3x^2$



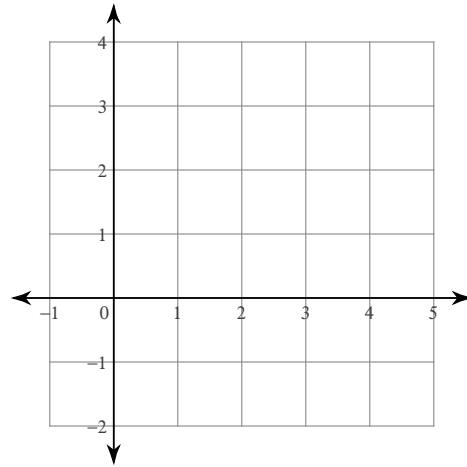
65) $y = 2x^2 - 16x + 35$



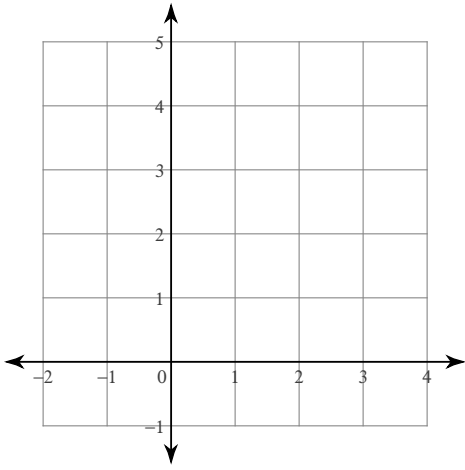
66) $y = x^2 + 6x + 7$



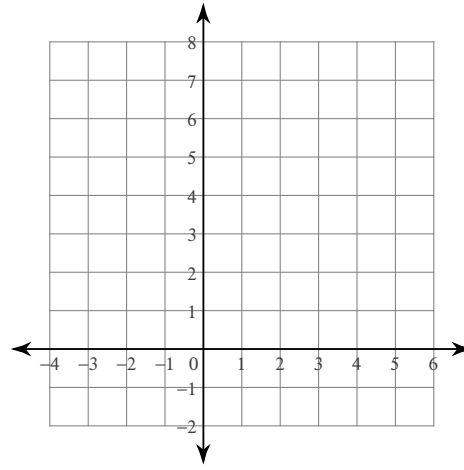
67) $y = x^2 - 6x + 8$



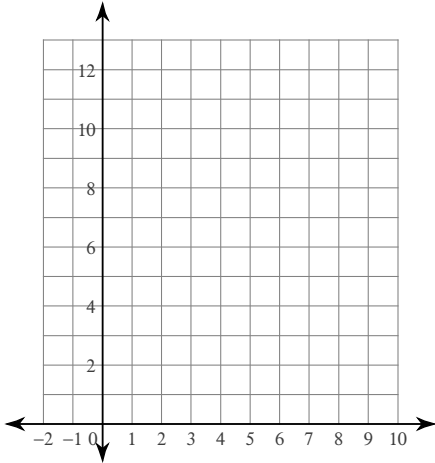
68) $y = -x^2 + 2x + 3$



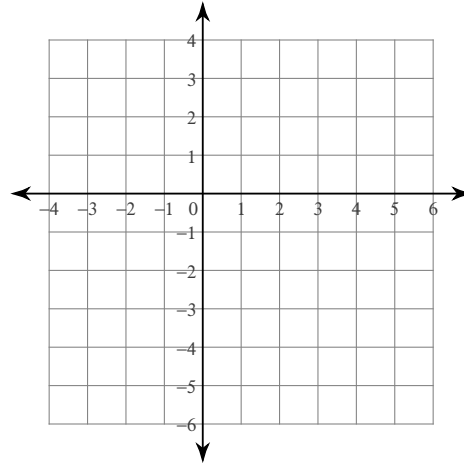
69) $y = 2x^2 - 12x + 17$



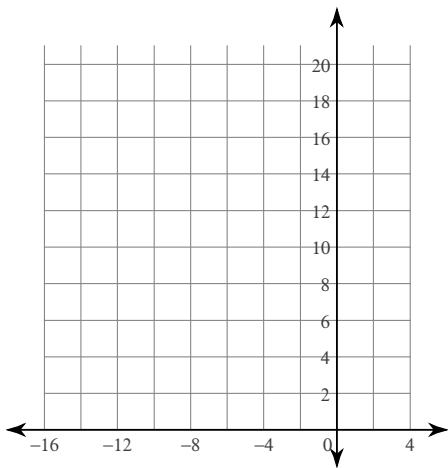
70) $y = 2x^2 - 8x + 12$



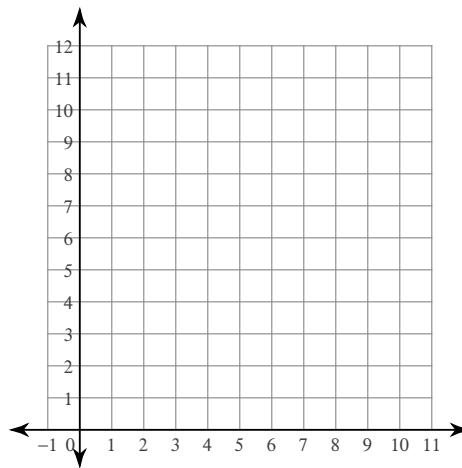
71) $y = -2x^2 + 4x + 1$



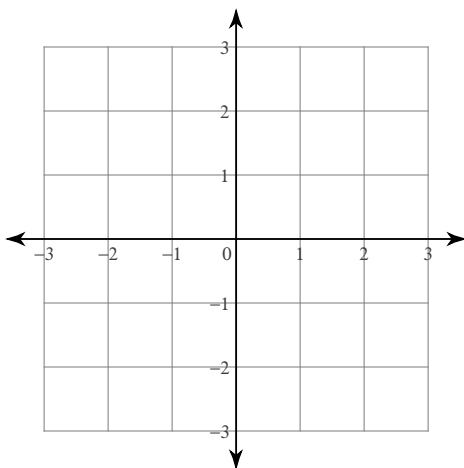
$$72) y = 4x^2 + 16x + 20$$



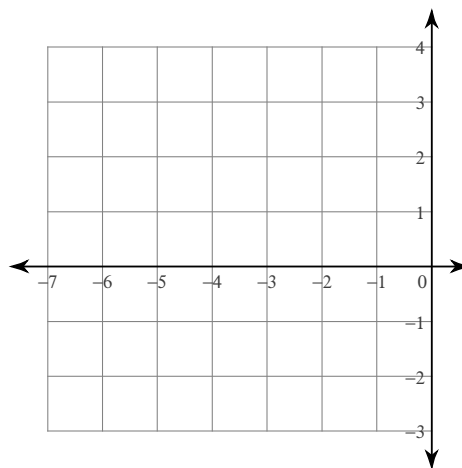
$$73) y = 2x^2 - 4x + 5$$



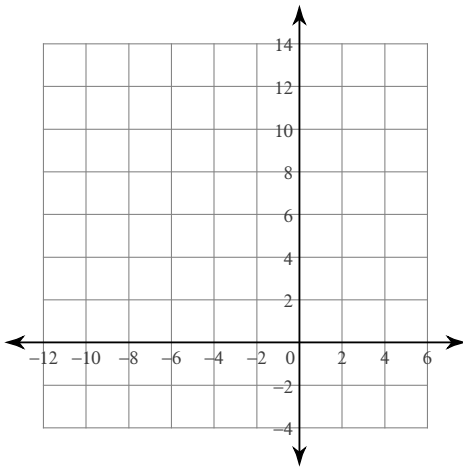
$$74) y = -x^2 - 2x + 1$$



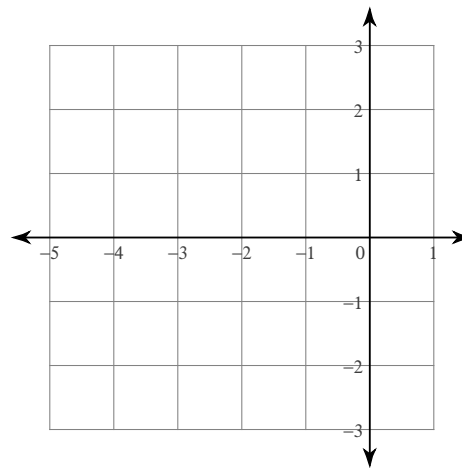
$$75) y = x^2 + 9x + 19$$



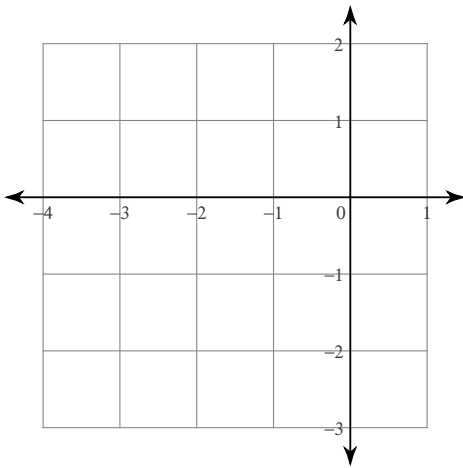
$$76) y = 4x^2 + 28x + 46$$



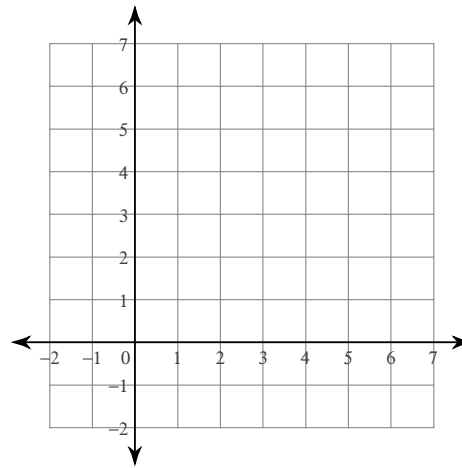
$$77) y = x^2 + 5x + \frac{17}{4}$$



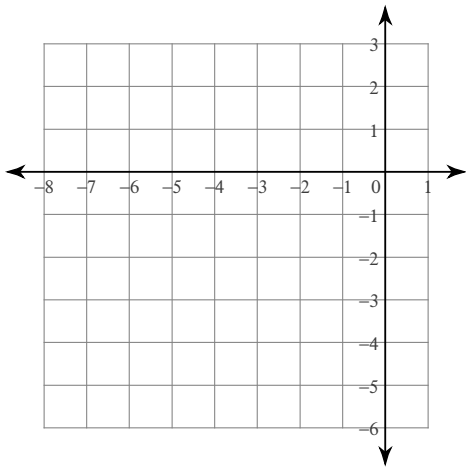
$$78) y = -x^2 - 3x - 1$$



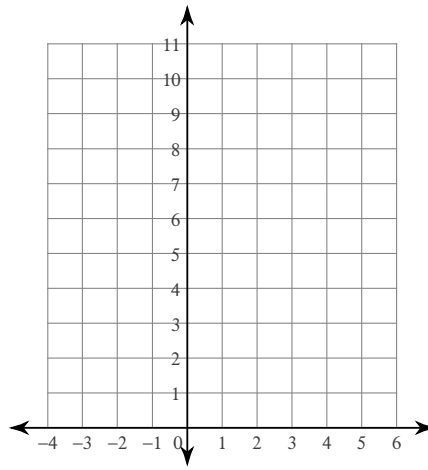
$$79) y = 2x^2 - 2x - 1$$



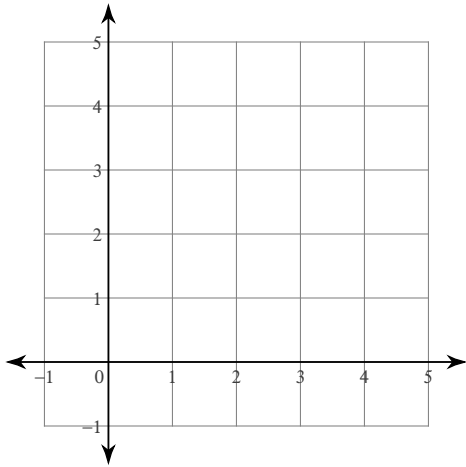
80) $y = -2x^2 - 6x - 2$



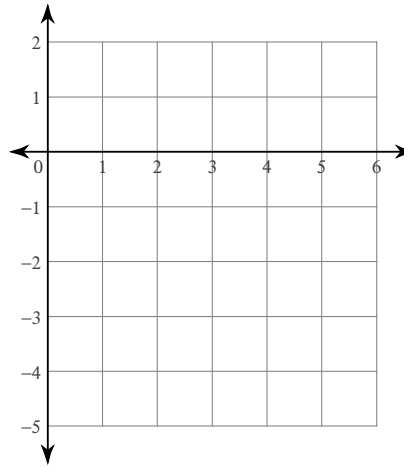
81) $y = 2x^2 - 10x + 15$



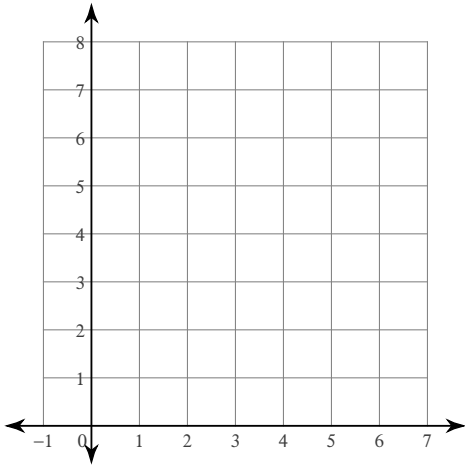
82) $y = x^2 - 5x + 7$



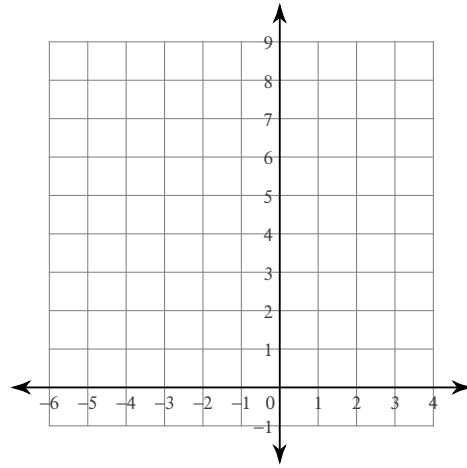
83) $y = x^2 - 5x + 3$



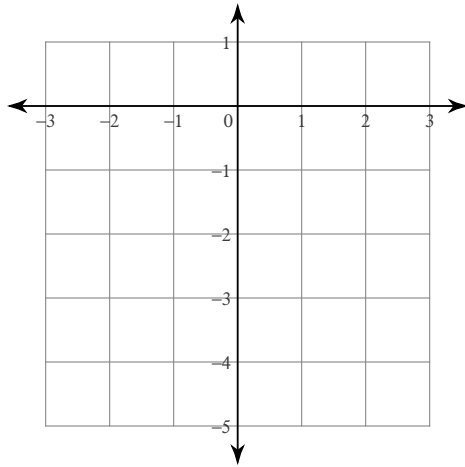
84) $y = x^2 - 7x + 16$



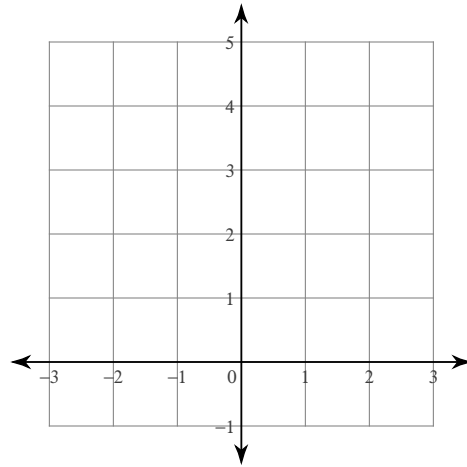
85) $y > 2x^2$



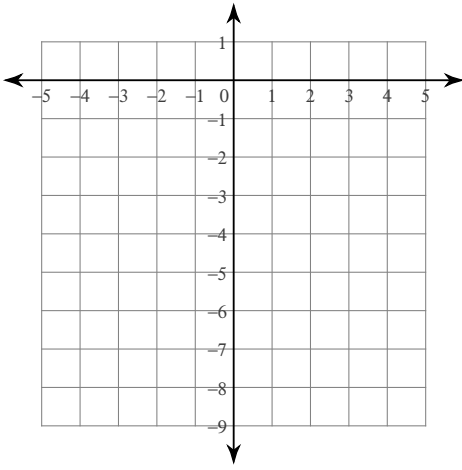
86) $y \geq -x^2$



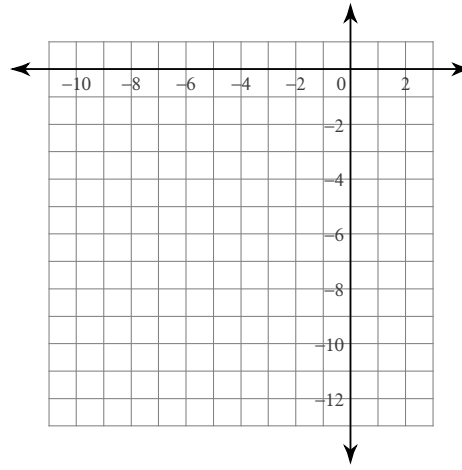
87) $y \geq x^2$



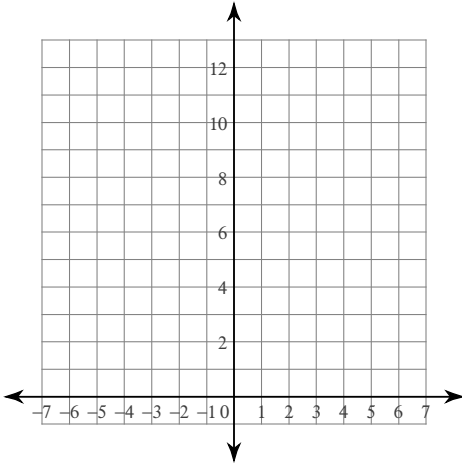
88) $y > -2x^2$



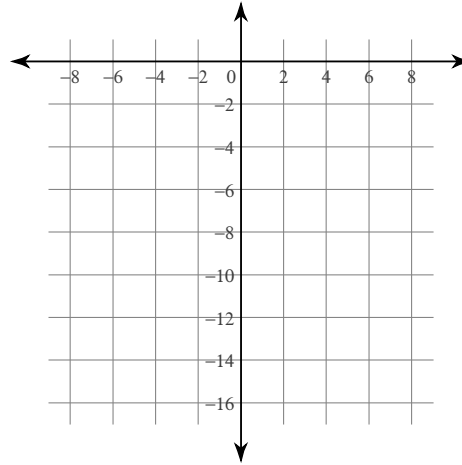
89) $y \leq -3x^2$



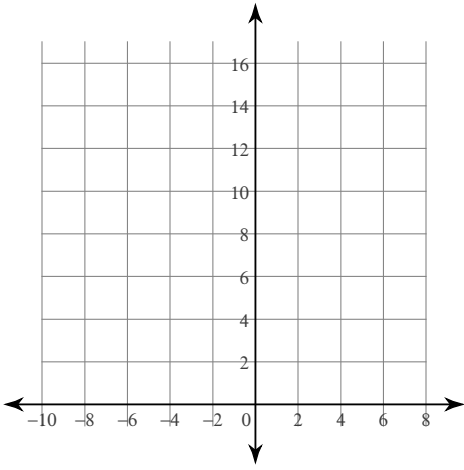
90) $y > 3x^2$



91) $y \leq -4x^2$

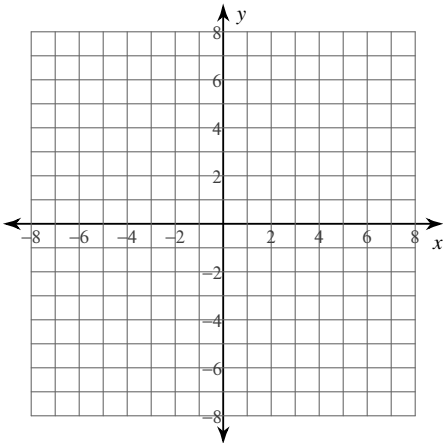


92) $y \geq 4x^2$

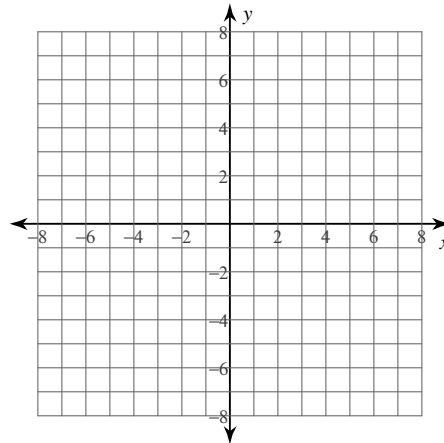


Graph each function.

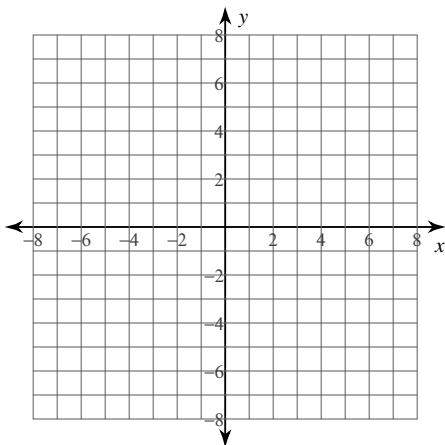
93) $f(x) = -\frac{4}{x} - 1$



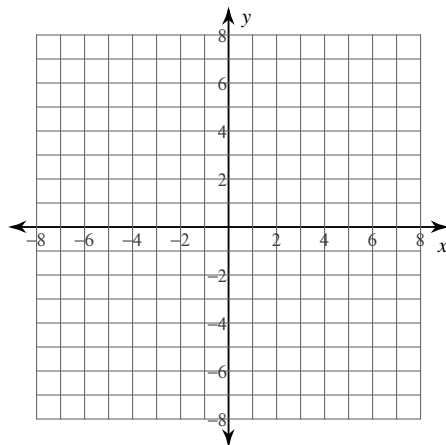
94) $f(x) = \frac{3}{x-1} - 2$



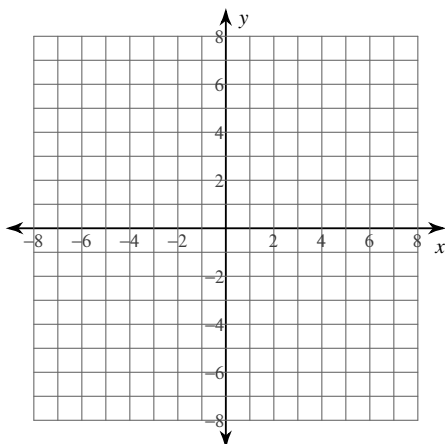
$$95) f(x) = -\frac{2}{x+1} + 2$$



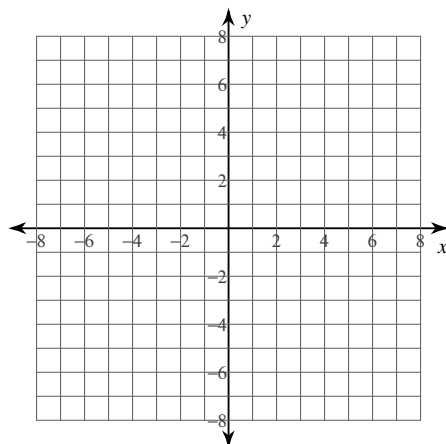
$$96) f(x) = -\frac{3}{x+2} - 1$$



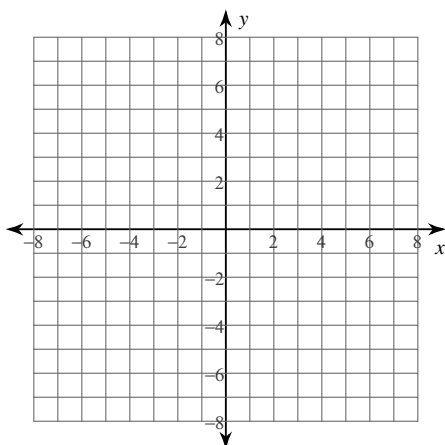
$$97) f(x) = \frac{1}{x+4} + 3$$



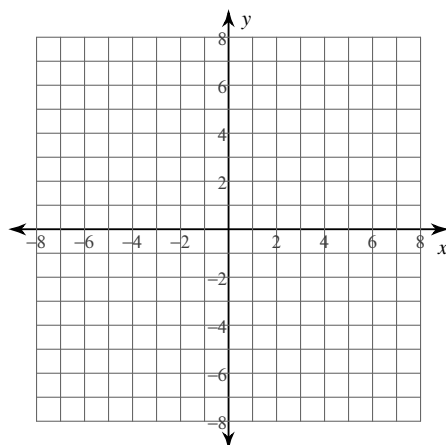
$$98) f(x) = -\frac{3}{x-2} - 1$$



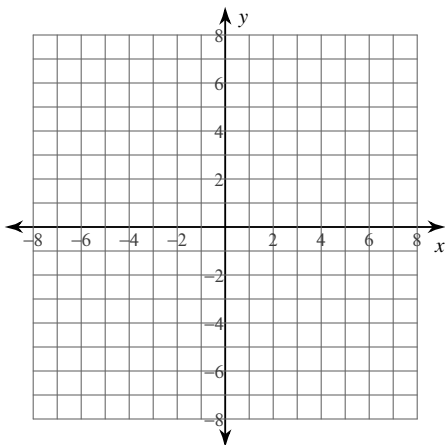
$$99) f(x) = \frac{3}{x} - 2$$



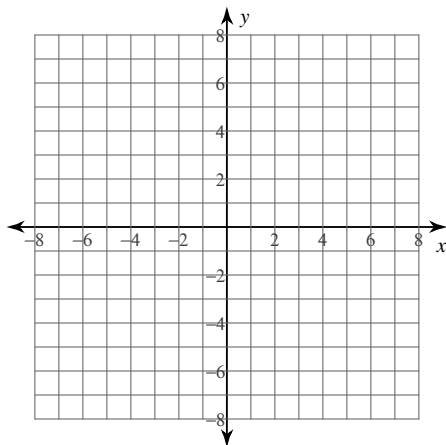
$$100) f(x) = -\frac{4}{x} + 1$$



$$101) f(x) = -\frac{4}{x-1} - 2$$

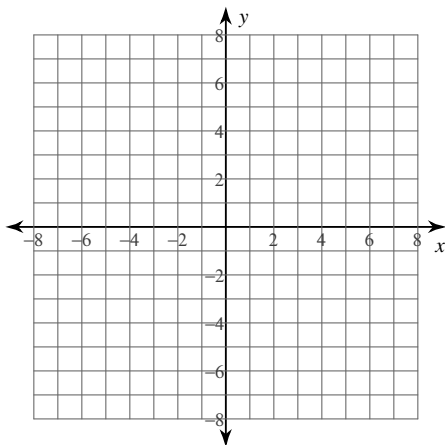


$$102) f(x) = \frac{4}{x+2} + 1$$

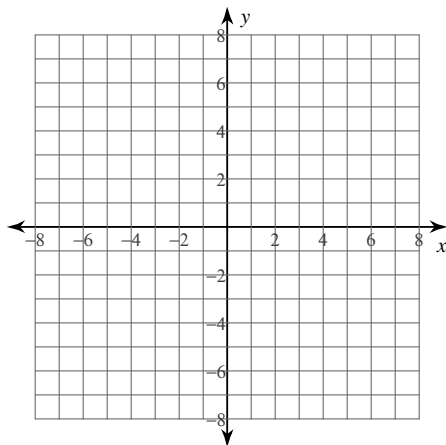


Identify the holes, vertical asymptotes, and horizontal asymptote of each. Then sketch the graph.

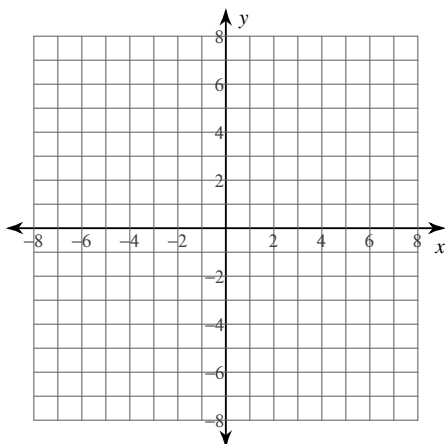
$$103) f(x) = \frac{2}{x-2} - 1$$



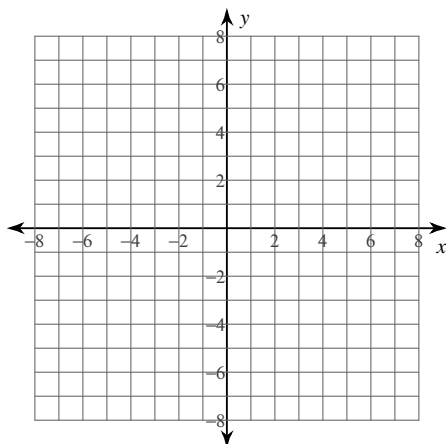
$$104) f(x) = \frac{2}{x-2}$$



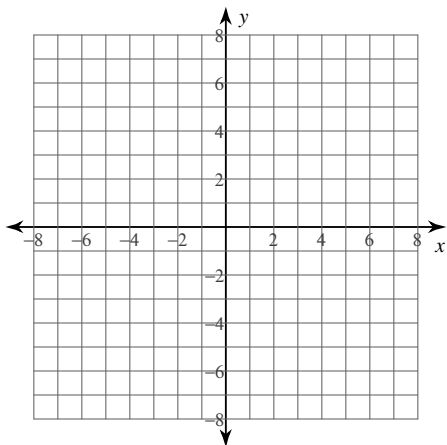
$$105) f(x) = \frac{2}{x} - 3$$



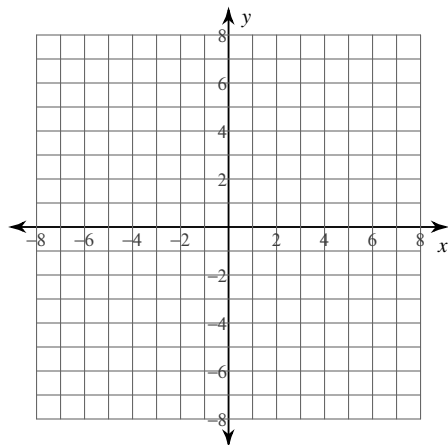
$$106) f(x) = \frac{3}{x-1} + 1$$



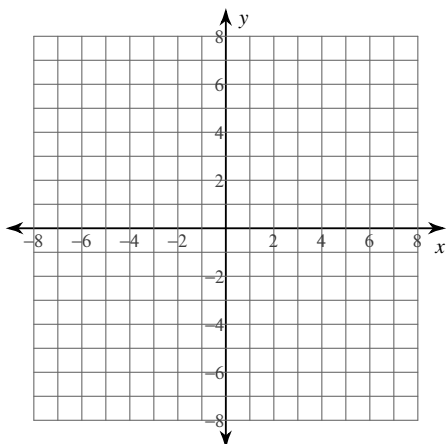
$$107) f(x) = \frac{2}{x} - 1$$



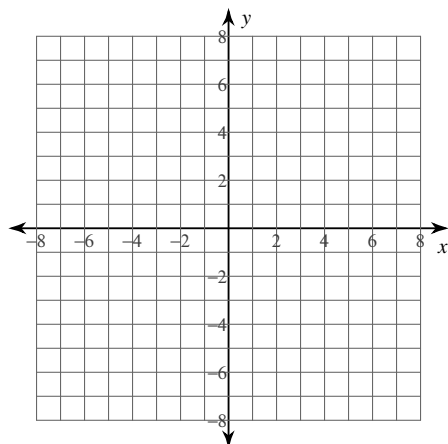
$$108) f(x) = -\frac{4}{x-1} + 2$$



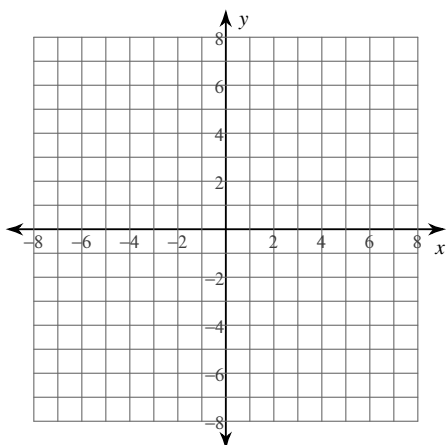
$$109) f(x) = -\frac{3}{x-2}$$



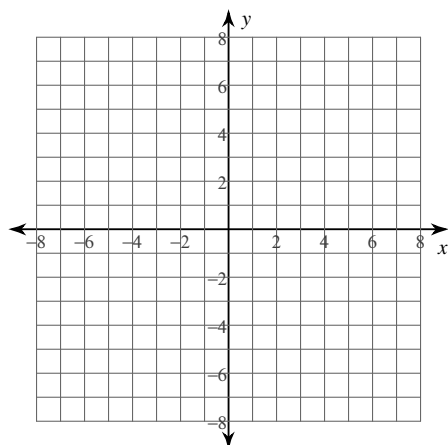
$$110) f(x) = -\frac{2}{x+1} - 3$$



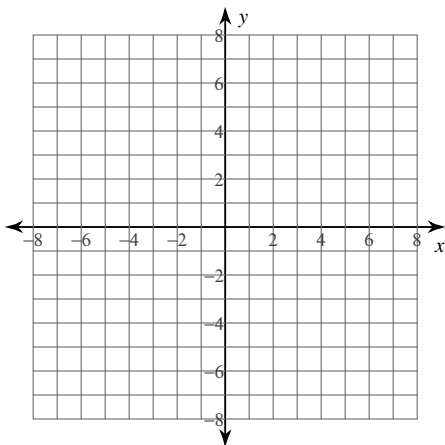
$$111) f(x) = \frac{4}{x-1} - 1$$



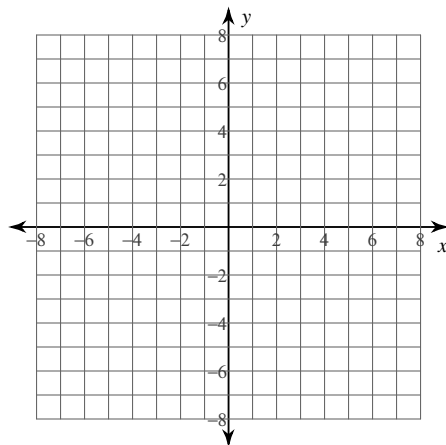
$$112) f(x) = -\frac{4}{x} + 1$$



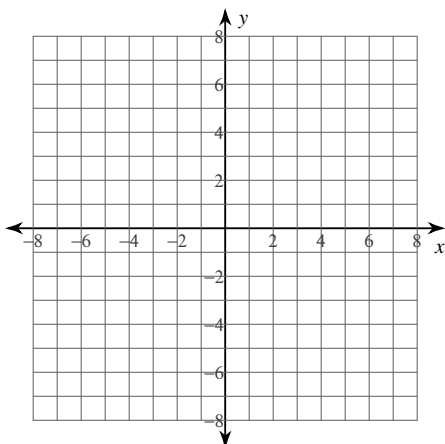
$$113) f(x) = -\frac{3}{x+1} - 1$$



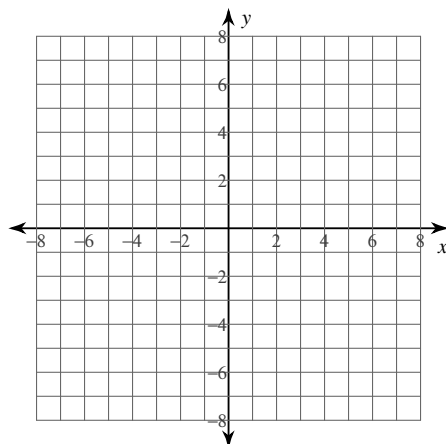
$$114) f(x) = -\frac{1}{x+2} - 3$$



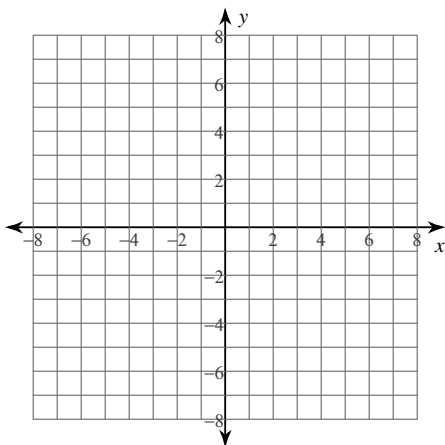
$$115) f(x) = -\frac{1}{x+3} - 1$$



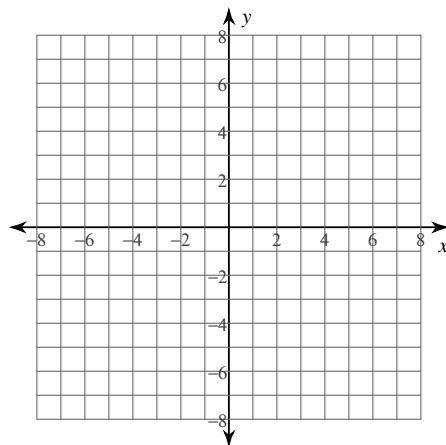
$$116) f(x) = -\frac{4}{x-2} - 2$$



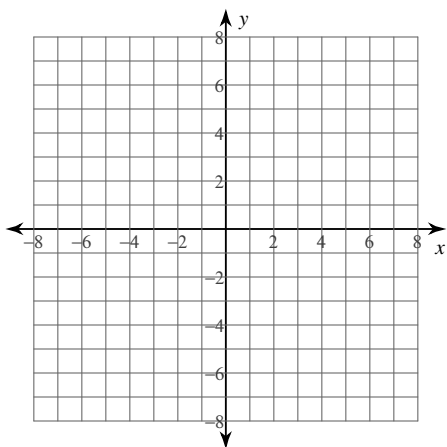
$$117) f(x) = -\frac{1}{x+2} + 3$$



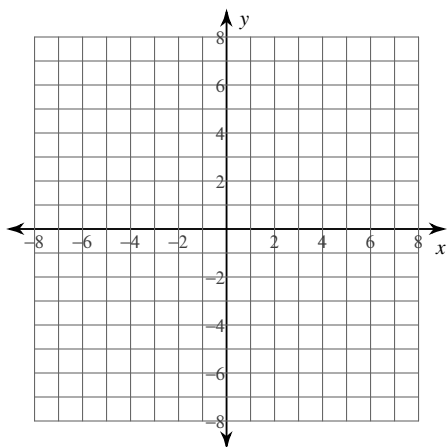
$$118) f(x) = \frac{2}{x+2} + 1$$



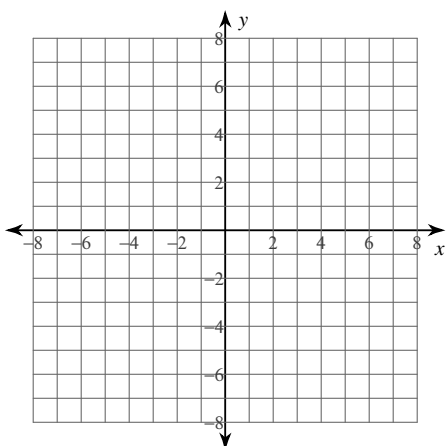
$$119) f(x) = \frac{3}{x-2} - 1$$



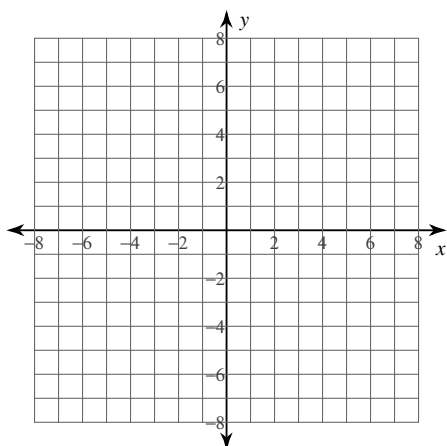
$$120) f(x) = -\frac{2}{x+1} - 1$$



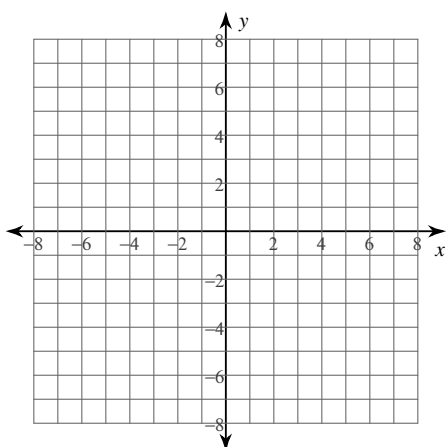
$$121) f(x) = -\frac{4}{x-1} - 1$$



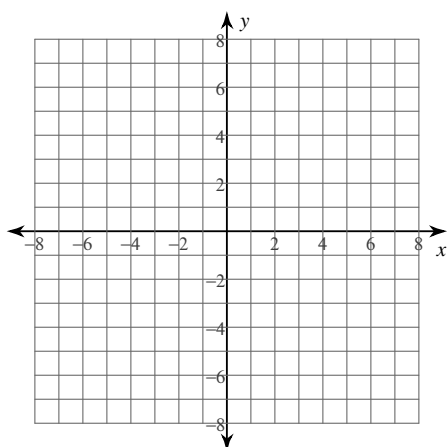
$$122) f(x) = -\frac{4}{x-1} + 1$$



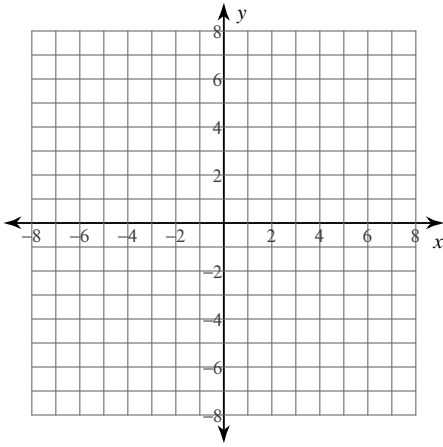
$$123) f(x) = \frac{4}{x} + 1$$



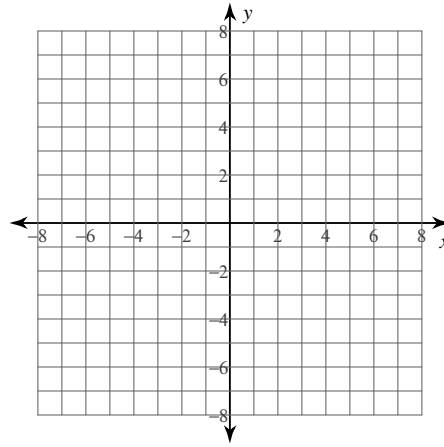
$$124) f(x) = \frac{1}{x+4} + 2$$



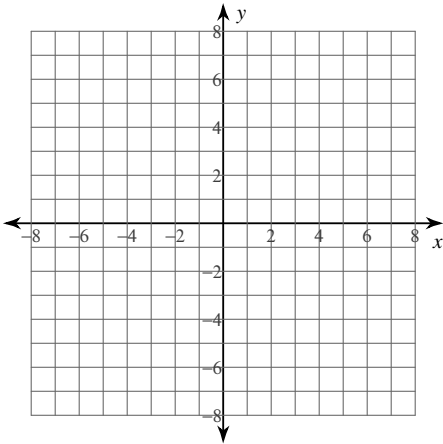
$$125) f(x) = \frac{1}{x+2} + 2$$



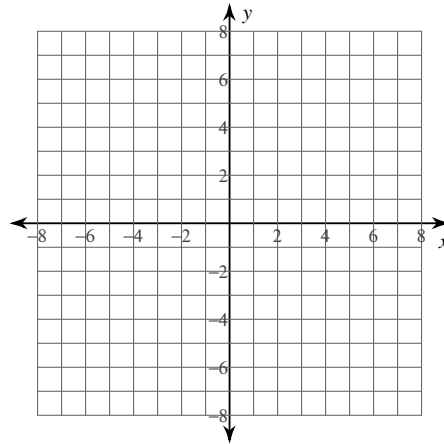
$$126) f(x) = \frac{2}{x+3} - 1$$



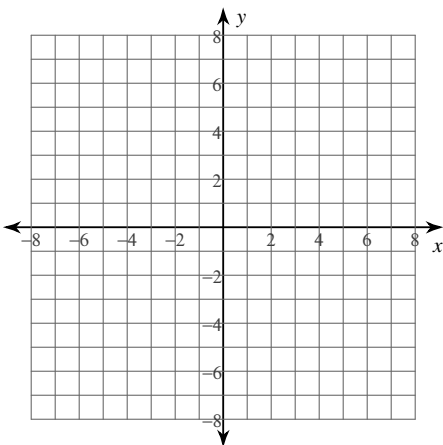
$$127) f(x) = -\frac{1}{x+1} - 3$$



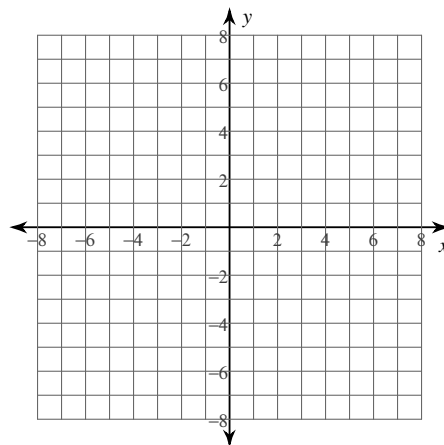
$$128) f(x) = -\frac{1}{x-3} + 1$$



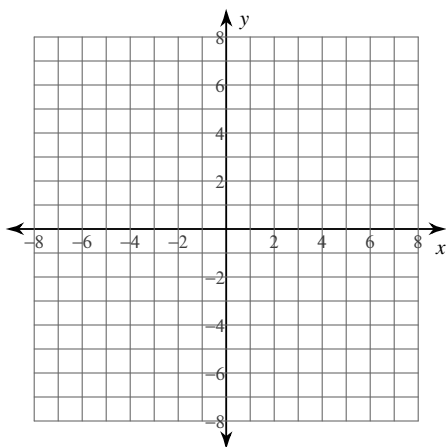
$$129) f(x) = -\frac{4}{x-2} - 1$$



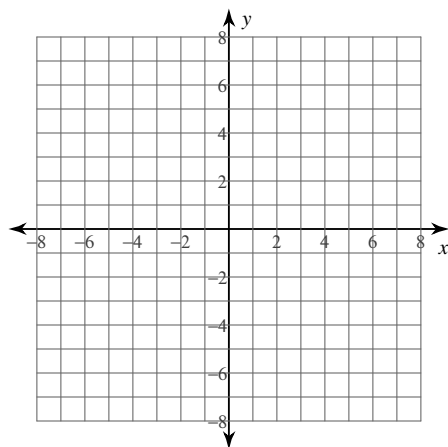
$$130) f(x) = -\frac{3}{x+1} - 2$$



$$131) f(x) = -\frac{2}{x-3} - 3$$



$$132) f(x) = -\frac{2}{x+3}$$



Describe the end behavior of each function.

$$133) f(x) = -x^4 + 2x^2 + x - 3$$

$$134) f(x) = -2x^2$$

$$135) f(x) = x^3 - 2x^2$$

$$136) f(x) = x^4 - 2x^2 - x - 3$$

$$137) f(x) = x^4 - 2x^2 - 2x + 2$$

$$138) f(x) = -2x^2 + 4x$$

$$139) f(x) = -x^4 + 4x^3 - 3x^2 - 2x$$

$$140) f(x) = x^4 - x^2 + x - 3$$

$$141) f(x) = -x^2 + 8x - 13$$

$$142) f(x) = x^2 - 6x + 8$$

$$143) f(x) = x^4 - x^3 - 3x^2$$

$$144) f(x) = x^3 - 3x^2 + 3$$

$$145) f(x) = -x^3 + 4x^2 - 7$$

$$146) f(x) = -2x^2 - 8x - 6$$

$$147) f(x) = x^4 + 4x^3 + 2x^2 - 5x - 4$$

$$148) f(x) = x^3 - 2x^2 - 1$$

$$149) f(x) = x^4 - 2x^2 - x + 4$$

$$150) f(x) = 2x^2 - 8x + 8$$

$$151) f(x) = -x^4 + x^3 + x^2 + 4$$

$$152) f(x) = -x^4 + x^2 - x + 1$$

153) $f(x) = x^4 + x^3 - 3x^2 + 1$

154) $f(x) = -x^3 + x^2 + 2$

155) $f(x) = -x^4 + 3x^2 + 2x + 2$

156) $f(x) = x^3 - 6x^2 + 9x - 3$

157) $f(x) = x^3 - x^2 + 2$

158) $f(x) = x^3 + 5x^2 + 8x + 8$

159) $f(x) = -x^4 + x^2 - 3$

160) $f(x) = x^3 - 4x^2 + 5x - 2$

161) $f(x) = x^3 - 9x^2 + 24x - 21$

162) $f(x) = x^3 - 5x^2 + 7x - 6$

163) $f(x) = -x^4 + x^3 + 3x^2 - 1$

164) $f(x) = x^5 - 2x^3 + x + 1$

165) $f(x) = x^4 + 4x^3 + 5x^2 + x$

166) $f(x) = -x^3 + 8x^2 - 20x + 17$

167) $f(x) = x^3 - 4x^2 + 6$

168) $f(x) = -x^4 + x^2 + x$

169) $f(x) = x^5 - 4x^3 + 4x + 3$

170) $f(x) = x^4 - 3x^2 + 3x + 1$

171) $f(x) = x^4 - 3x^2 + 2x + 4$

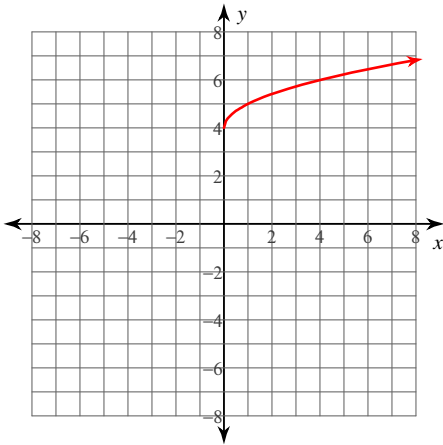
172) $f(x) = -x^5 + 4x^3 - x$

function families

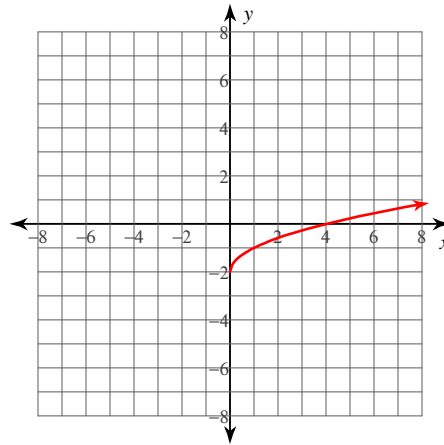
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Sketch the graph of each function.

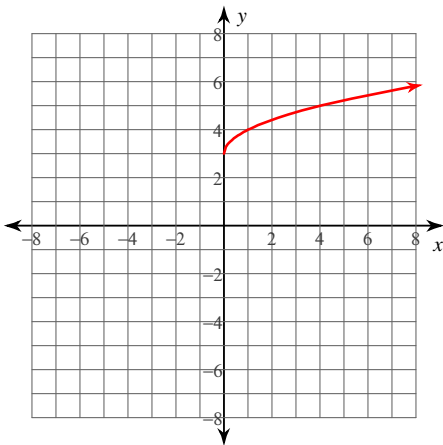
1) $y = \sqrt{x} + 4$



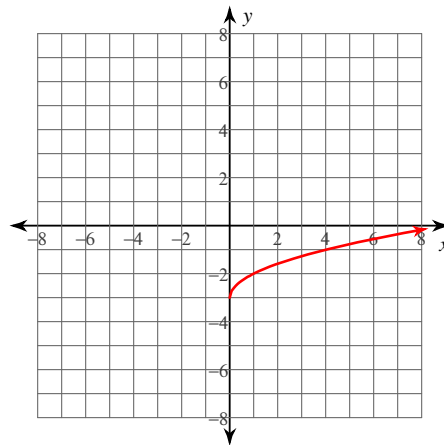
2) $y = \sqrt{x} - 2$



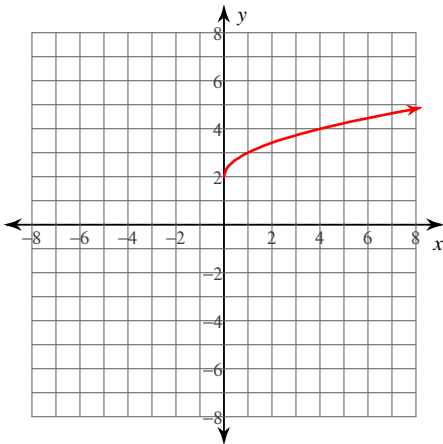
3) $y = \sqrt{x} + 3$



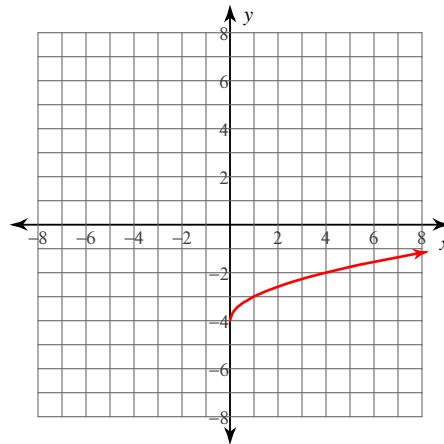
4) $y = -3 + \sqrt{x}$



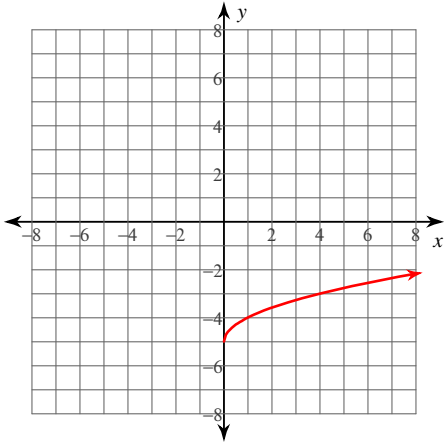
5) $y = \sqrt{x} + 2$



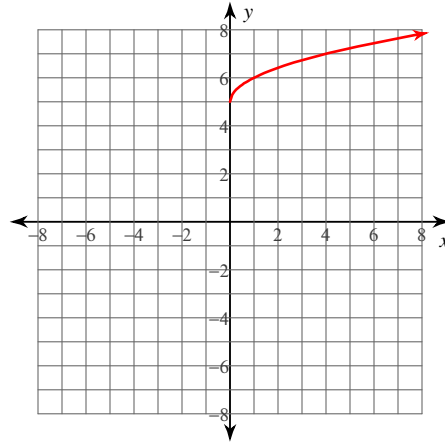
6) $y = \sqrt{x} - 4$



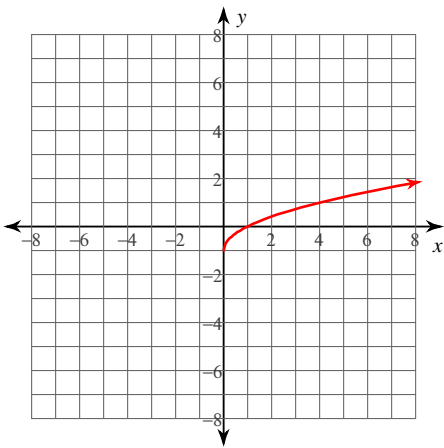
7) $y = \sqrt{x} - 5$



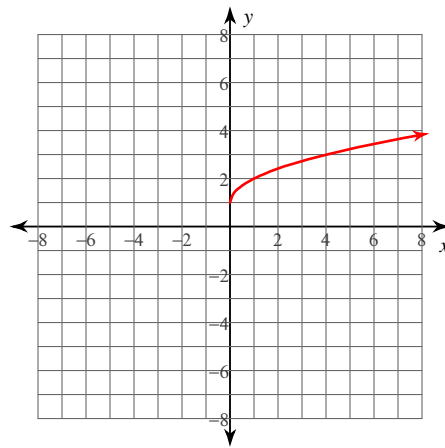
8) $y = \sqrt{x} + 5$



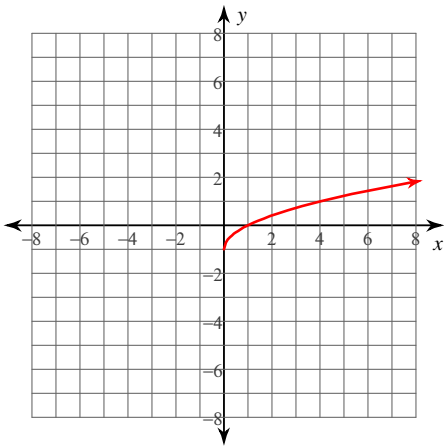
9) $y = -1 + \sqrt{x}$



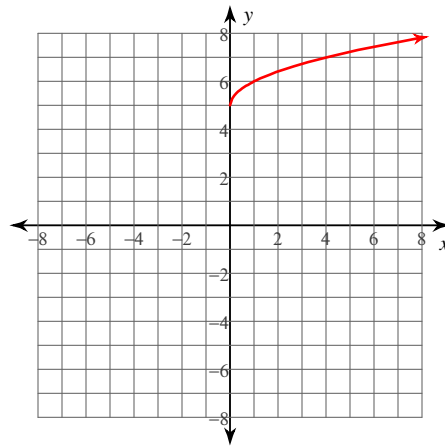
10) $y = 1 + \sqrt{x}$



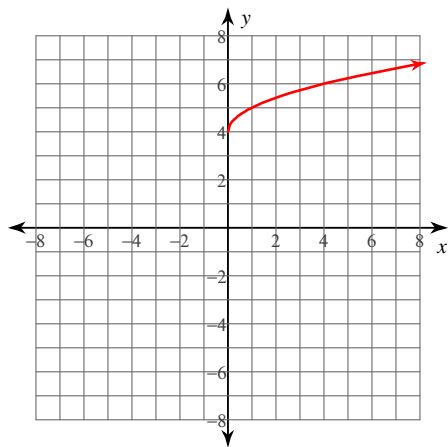
11) $y = \sqrt{x} - 1$



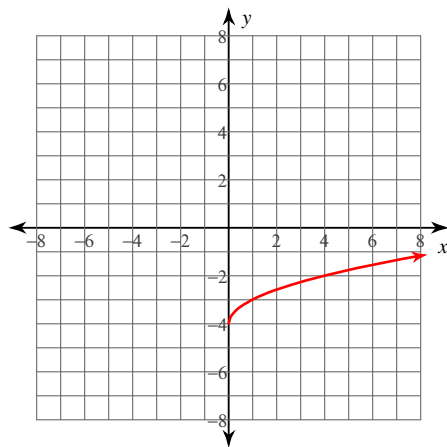
12) $y = \sqrt{x} + 5$



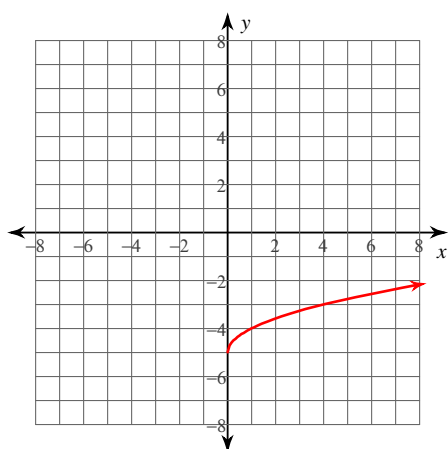
13) $y = \sqrt{x} + 4$



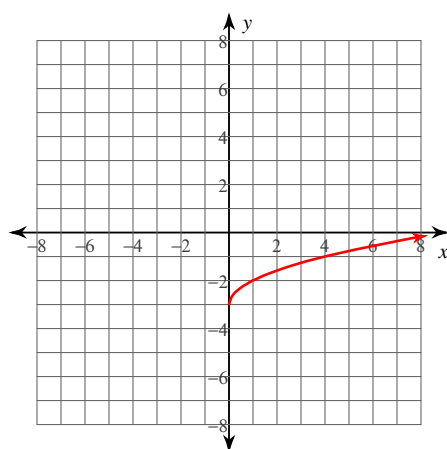
14) $y = -4 + \sqrt{x}$



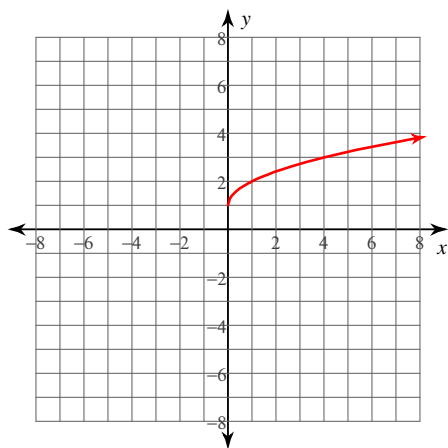
15) $y = -5 + \sqrt{x}$



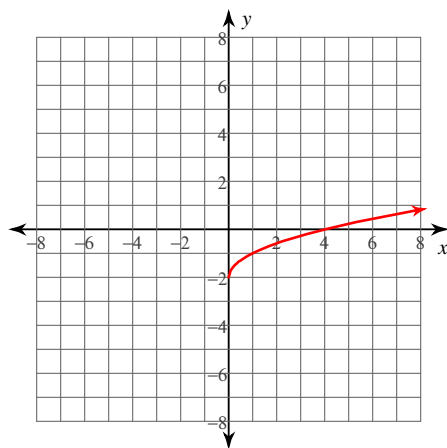
16) $y = \sqrt{x} - 3$



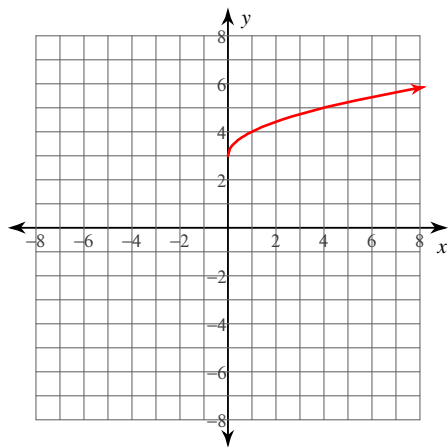
17) $y = \sqrt{x} + 1$



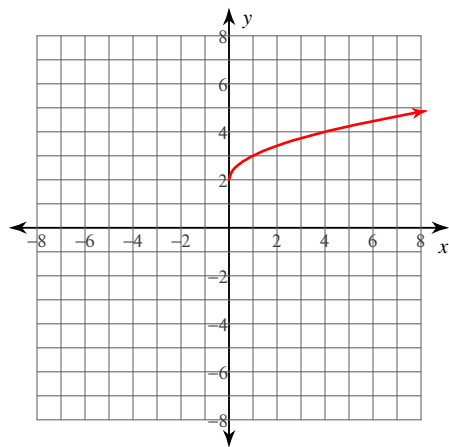
18) $y = -2 + \sqrt{x}$



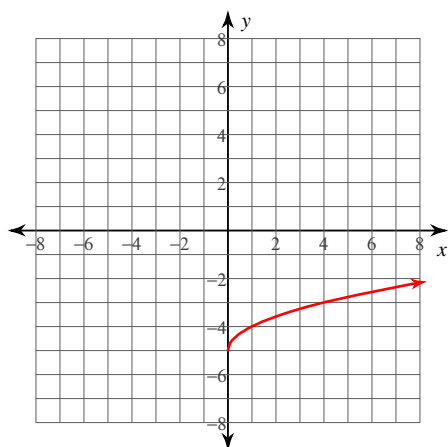
$$19) y = \sqrt{x} + 3$$



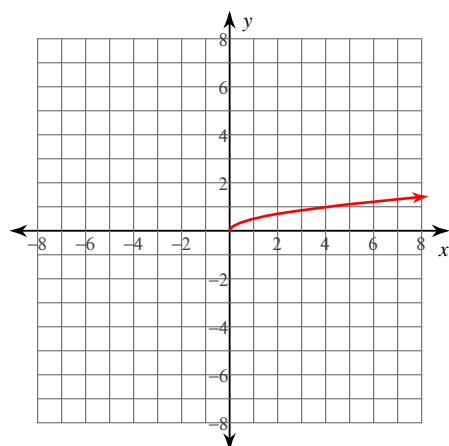
$$20) y = 2 + \sqrt{x}$$



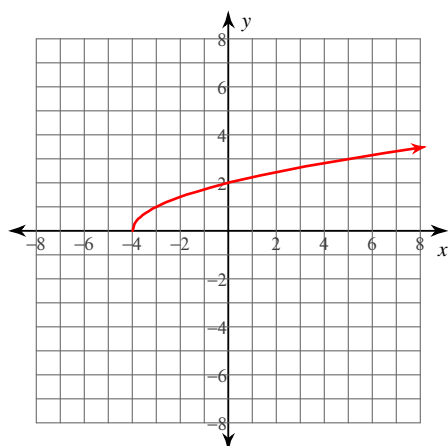
$$21) y = \sqrt{x} - 5$$



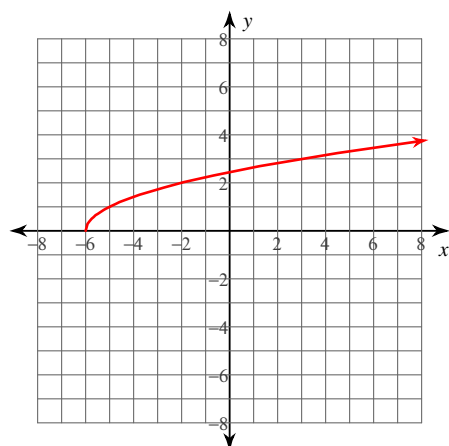
$$22) y = \frac{1}{2}\sqrt{x}$$



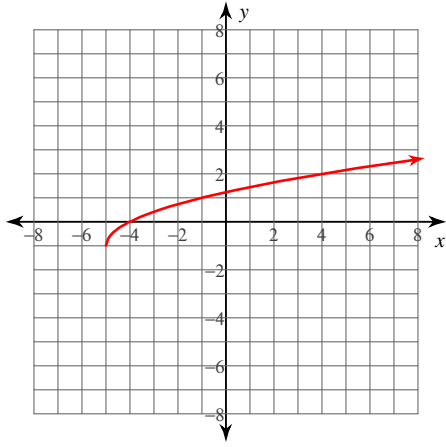
$$23) y = \sqrt{x+4}$$



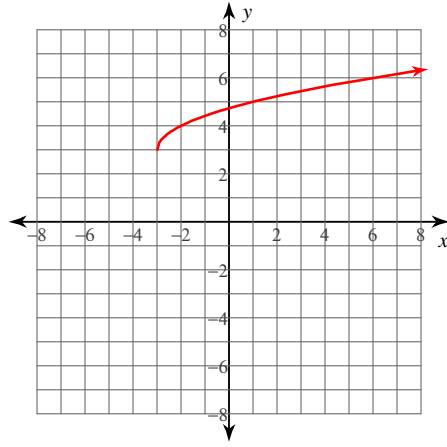
$$24) y = \sqrt{x+6}$$



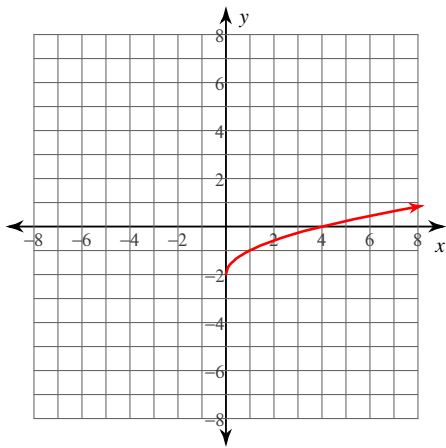
$$25) y = \sqrt{x+5} - 1$$



$$26) y = \sqrt{x+3} + 3$$

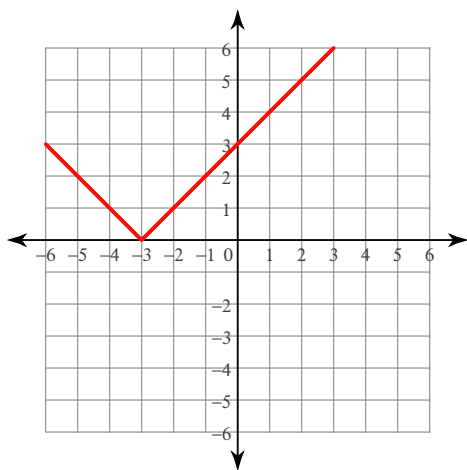


$$27) y = \sqrt{x} - 2$$

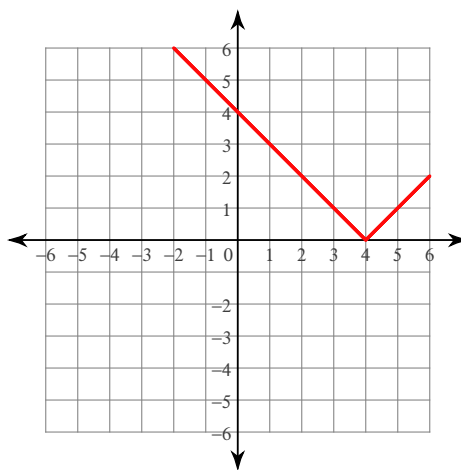


Graph each equation.

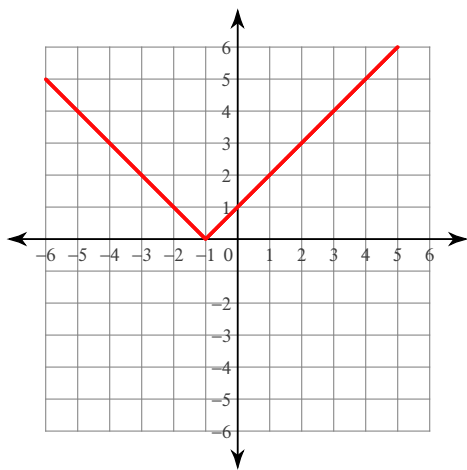
28) $y = |x + 3|$



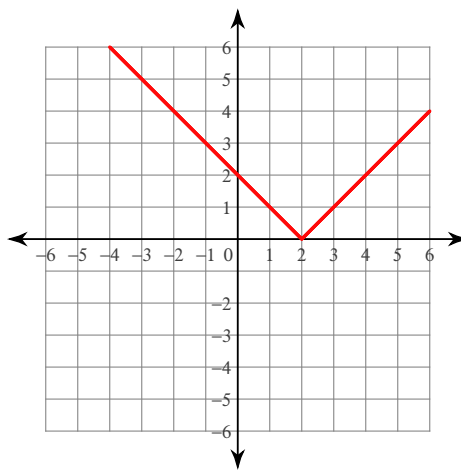
29) $y = |x - 4|$



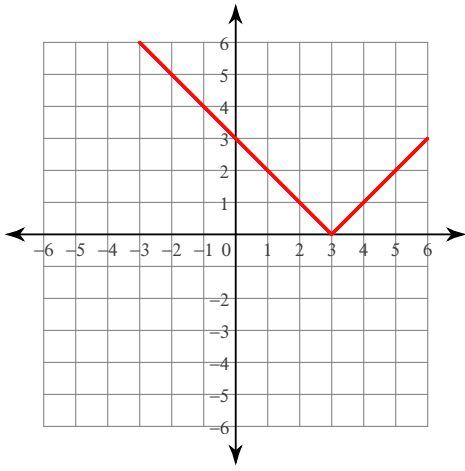
30) $y = |x + 1|$



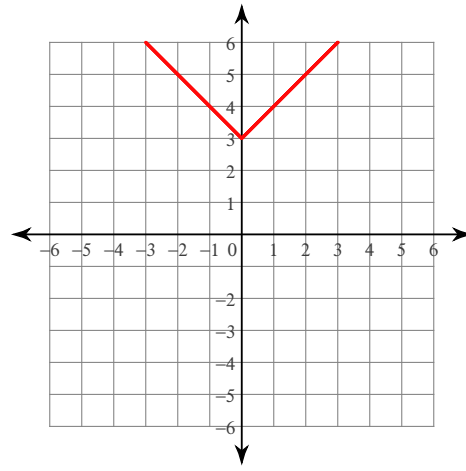
31) $y = |x - 2|$



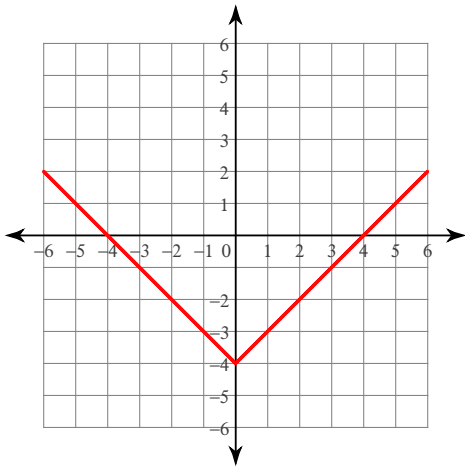
$$32) y = |x - 3|$$



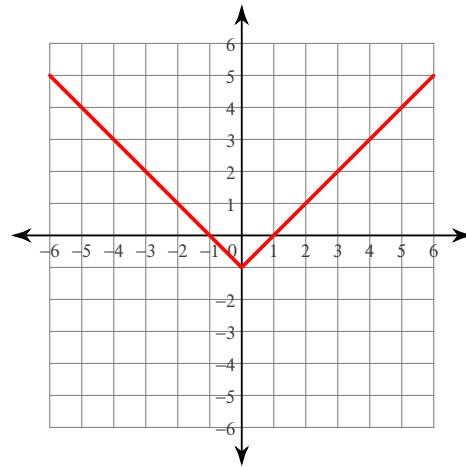
$$33) y = |x| + 3$$



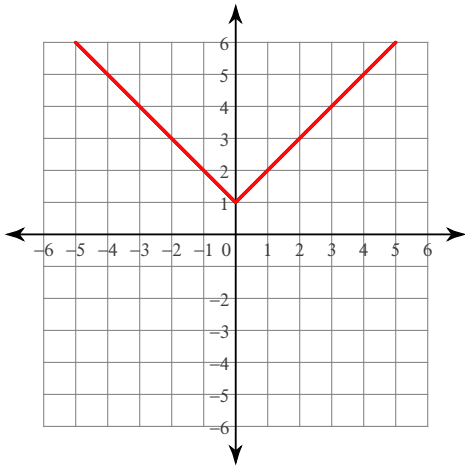
$$34) y = |x| - 4$$



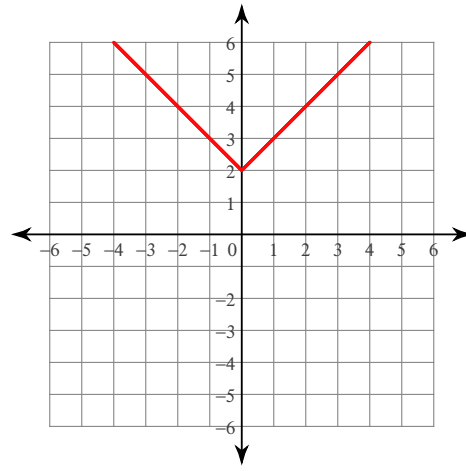
$$35) y = |x| - 1$$



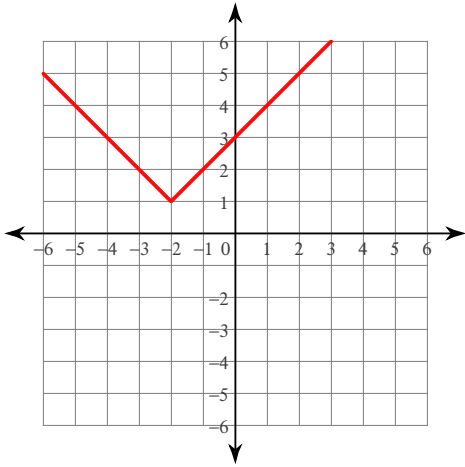
36) $y = |x| + 1$



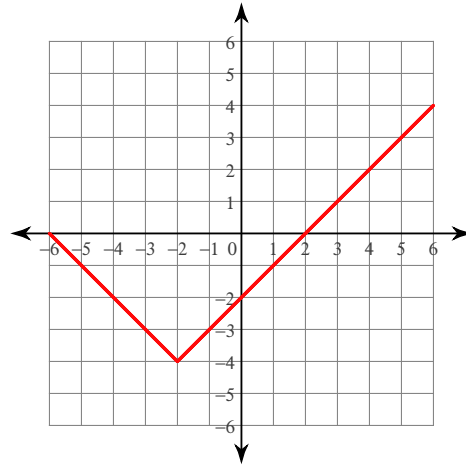
37) $y = |x| + 2$



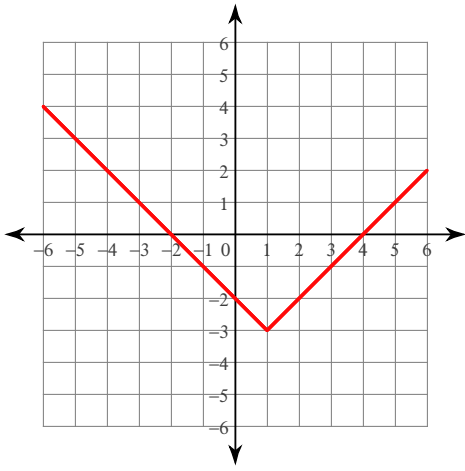
38) $y = |x + 2| + 1$



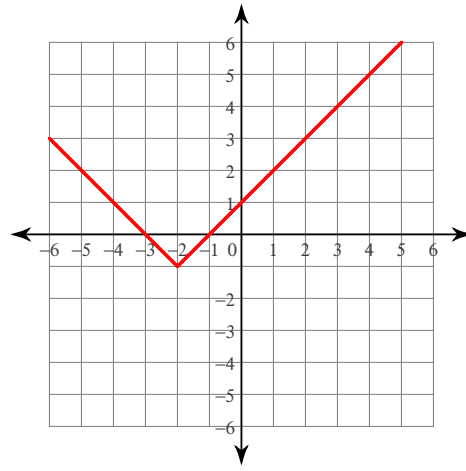
39) $y = |x + 2| - 4$



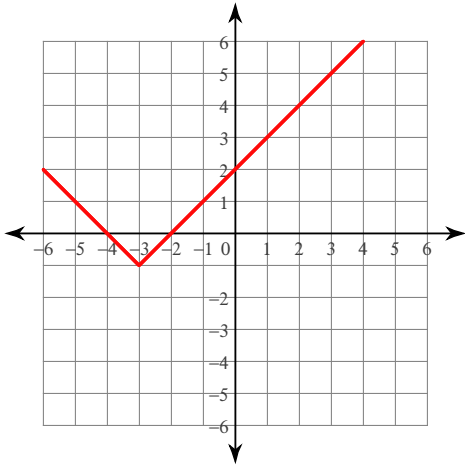
$$40) y = |x - 1| - 3$$



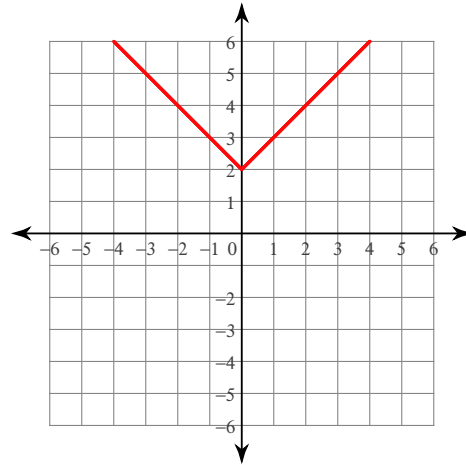
$$41) y = |x + 2| - 1$$



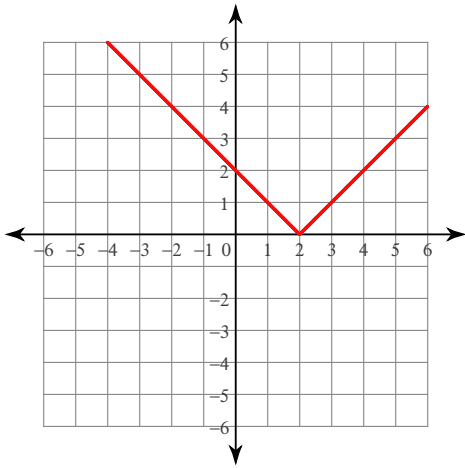
$$42) y = |x + 3| - 1$$



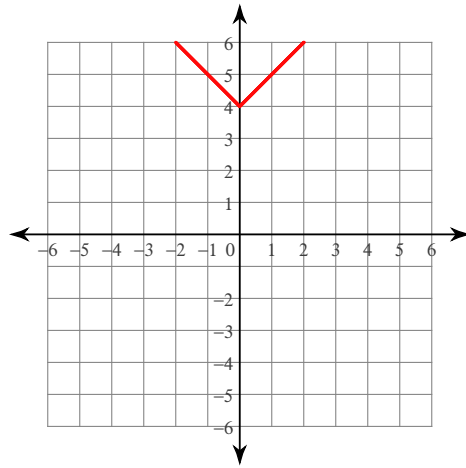
$$43) y = |x| + 2$$



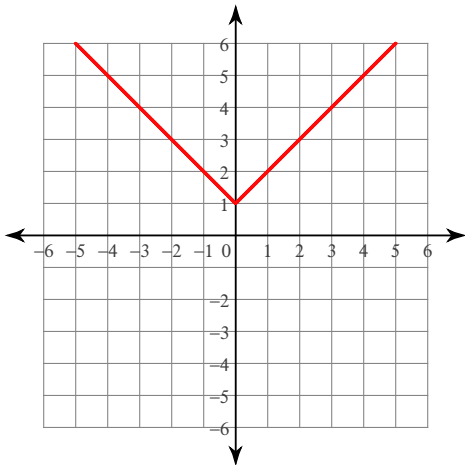
$$44) y = |x - 2|$$



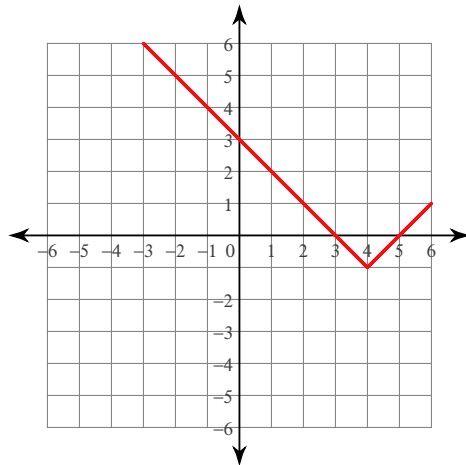
$$45) y = |x| + 4$$



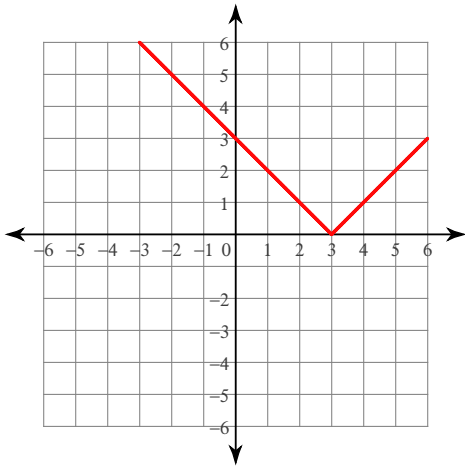
$$46) y = |x| + 1$$



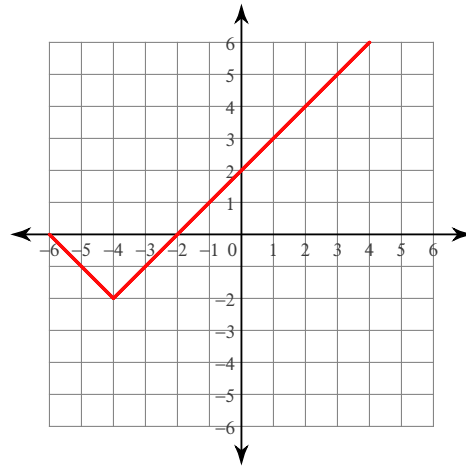
$$47) y = |x - 4| - 1$$



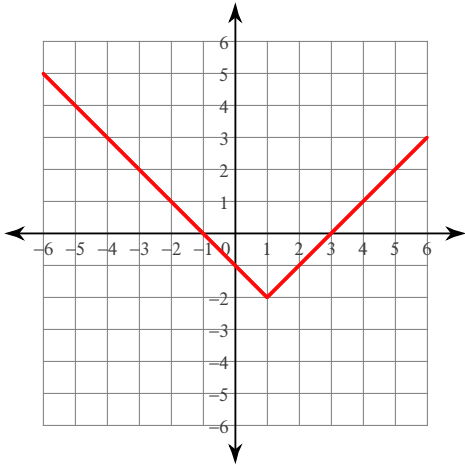
$$48) y = |x - 3|$$



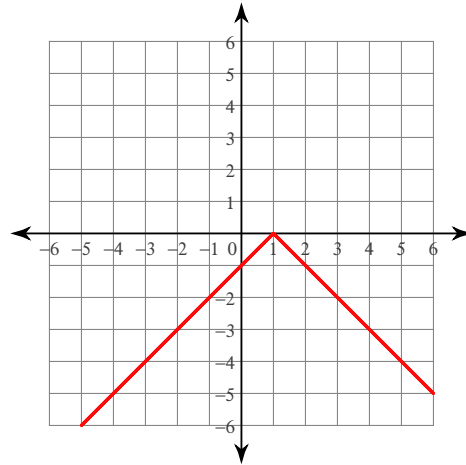
$$49) y = |x + 4| - 2$$



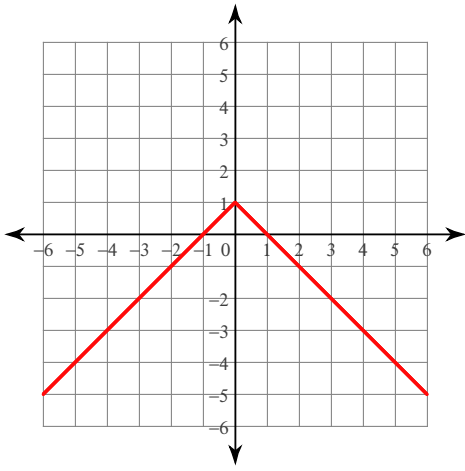
$$50) y = |x - 1| - 2$$



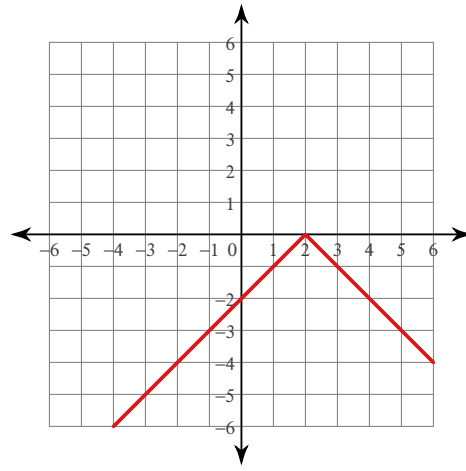
$$51) y = -|x - 1|$$



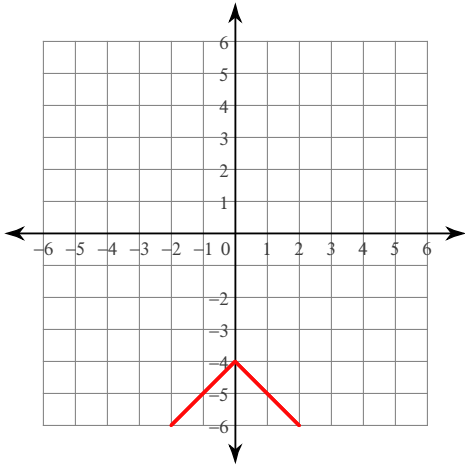
$$52) y = -|x| + 1$$



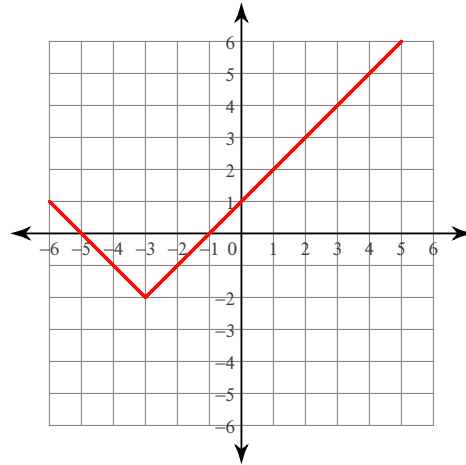
$$53) y = -|x - 2|$$



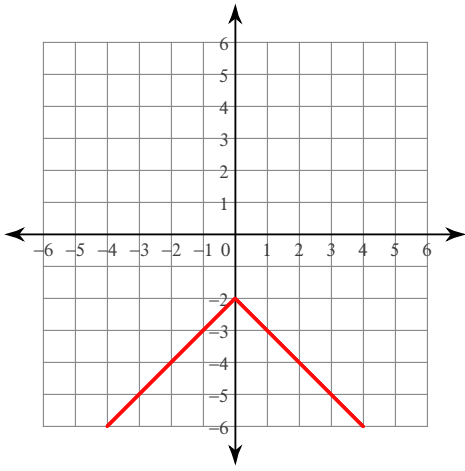
$$54) y = -|x| - 4$$



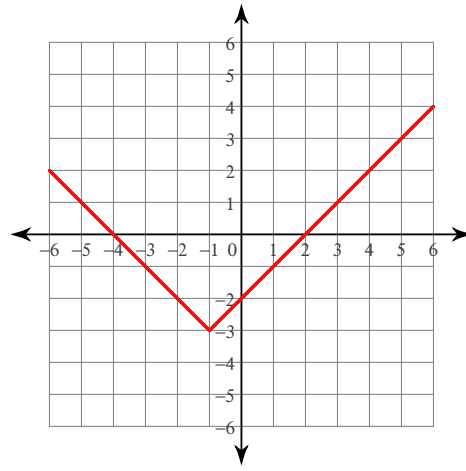
$$55) y = |x + 3| - 2$$



56) $y = -|x| - 2$

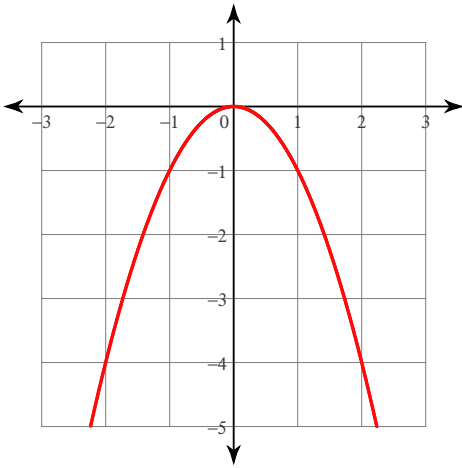


57) $y = |x + 1| - 3$

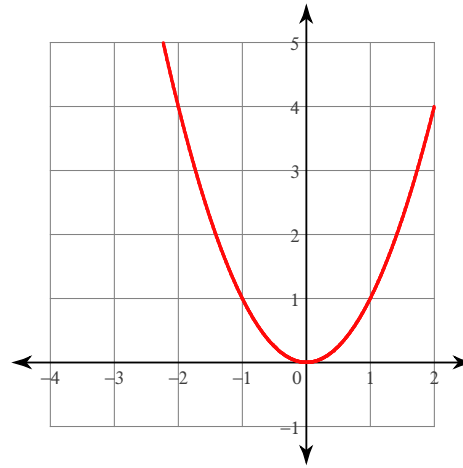


Sketch the graph of each function.

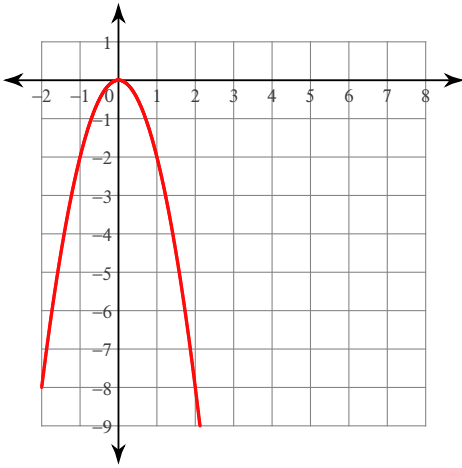
58) $y = -x^2$



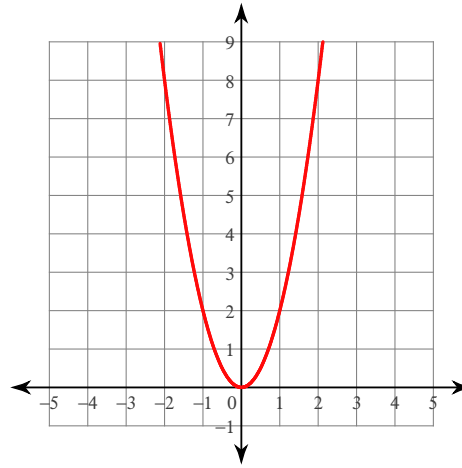
59) $y = x^2$



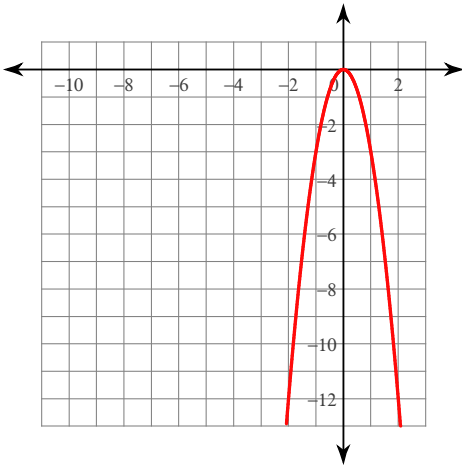
60) $y = -2x^2$



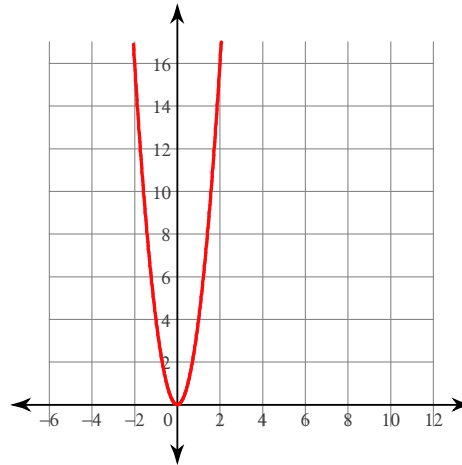
61) $y = 2x^2$



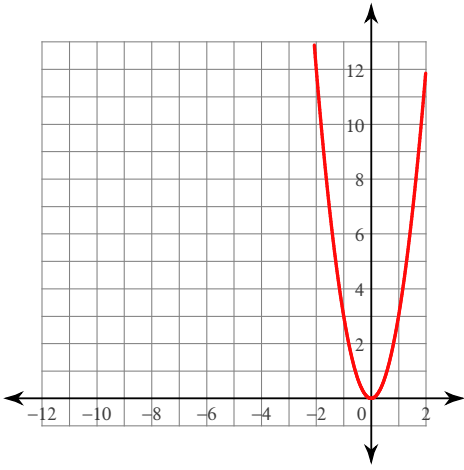
62) $y = -3x^2$



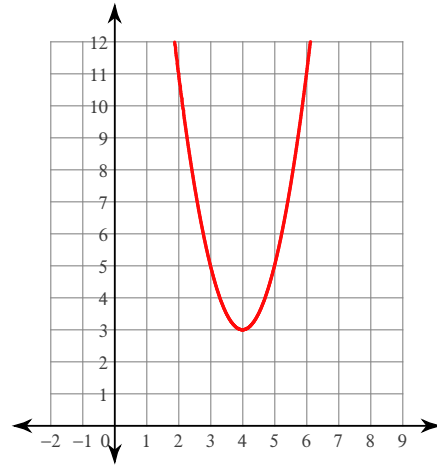
63) $y = 4x^2$



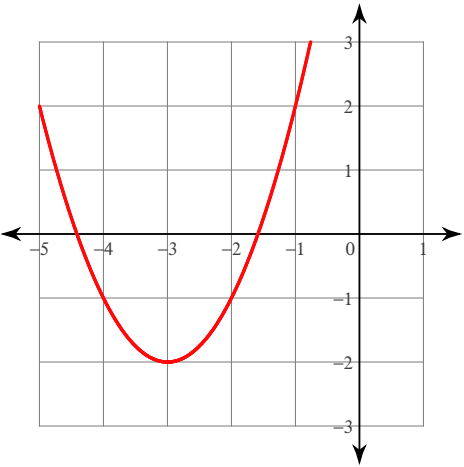
64) $y = 3x^2$



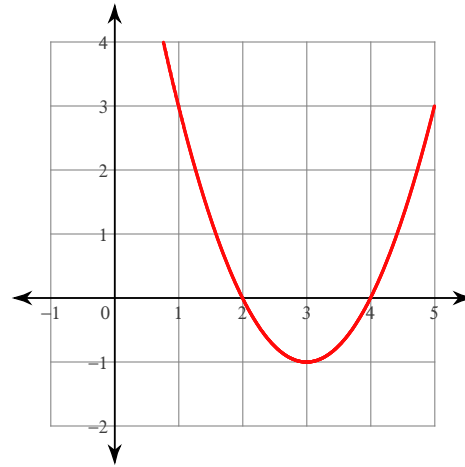
65) $y = 2x^2 - 16x + 35$



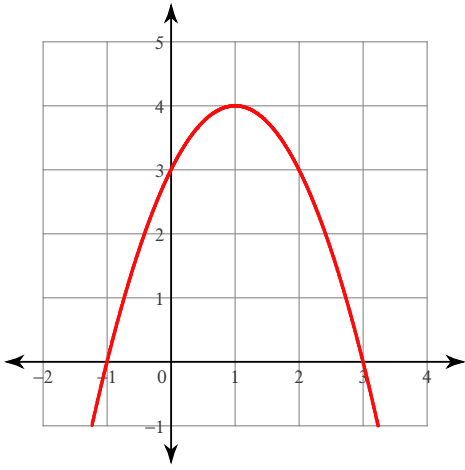
66) $y = x^2 + 6x + 7$



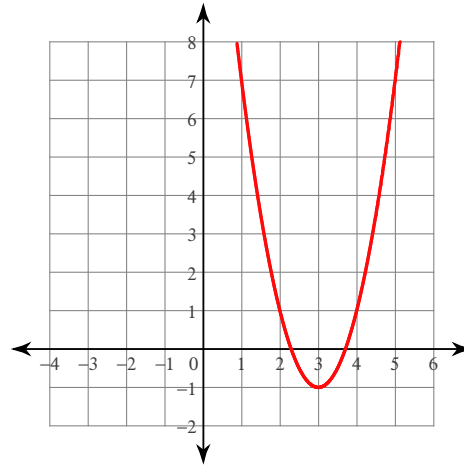
67) $y = x^2 - 6x + 8$



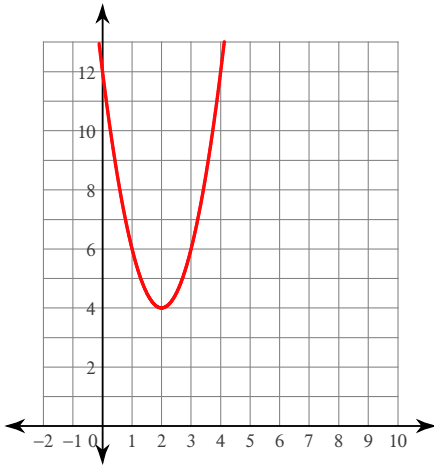
68) $y = -x^2 + 2x + 3$



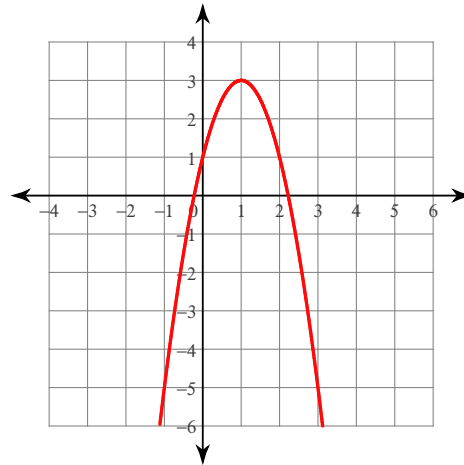
69) $y = 2x^2 - 12x + 17$



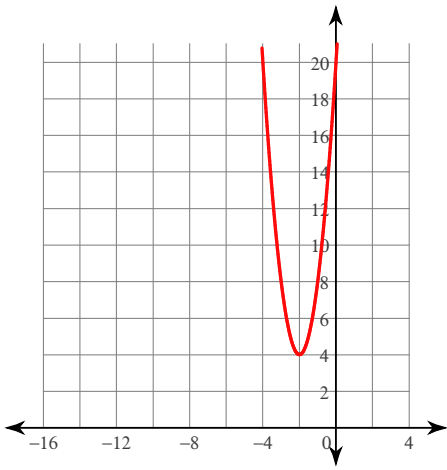
70) $y = 2x^2 - 8x + 12$



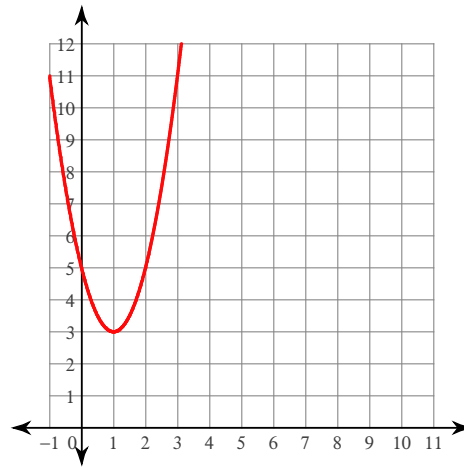
71) $y = -2x^2 + 4x + 1$



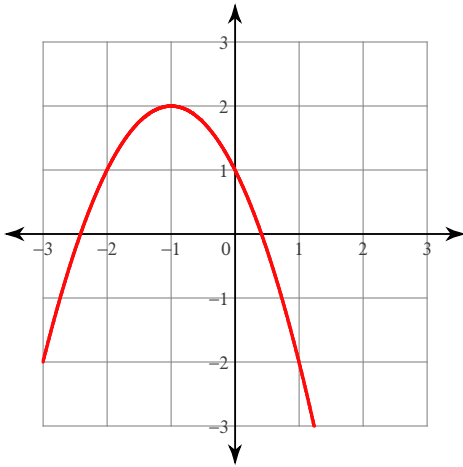
72) $y = 4x^2 + 16x + 20$



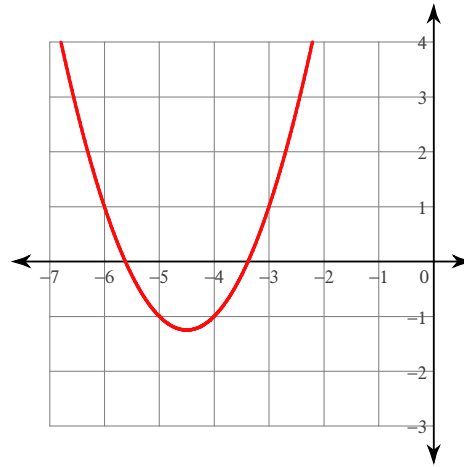
73) $y = 2x^2 - 4x + 5$



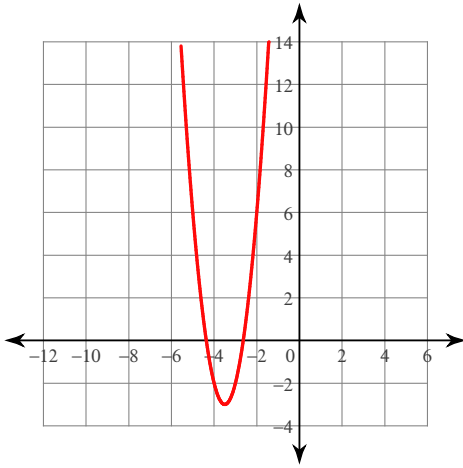
74) $y = -x^2 - 2x + 1$



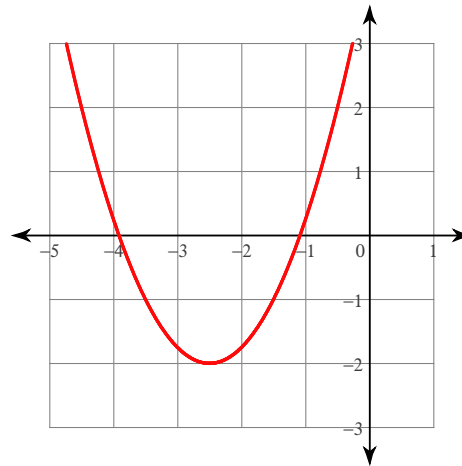
75) $y = x^2 + 9x + 19$



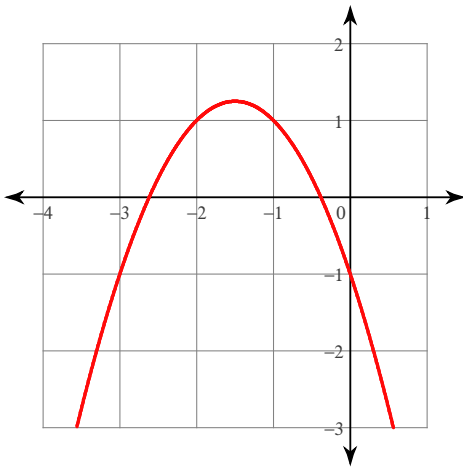
76) $y = 4x^2 + 28x + 46$



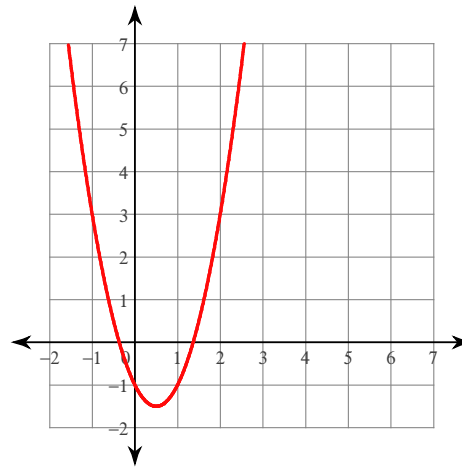
77) $y = x^2 + 5x + \frac{17}{4}$



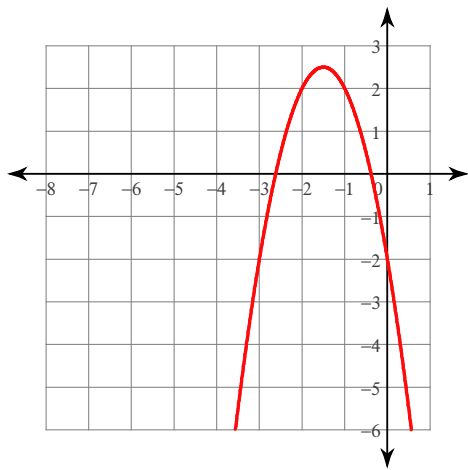
78) $y = -x^2 - 3x - 1$



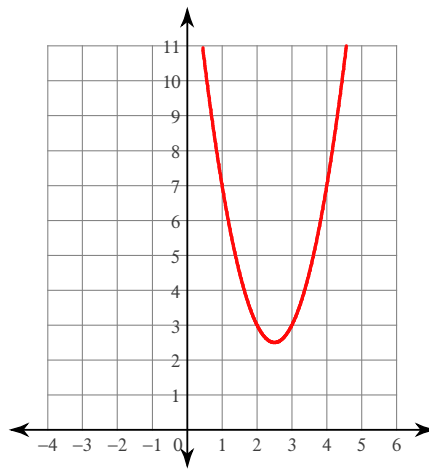
79) $y = 2x^2 - 2x - 1$



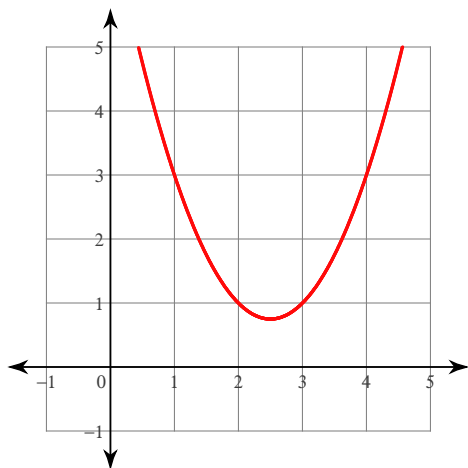
80) $y = -2x^2 - 6x - 2$



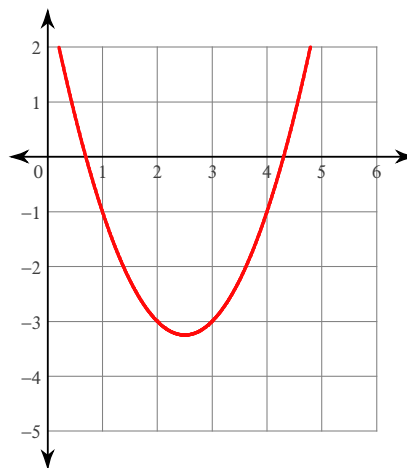
81) $y = 2x^2 - 10x + 15$



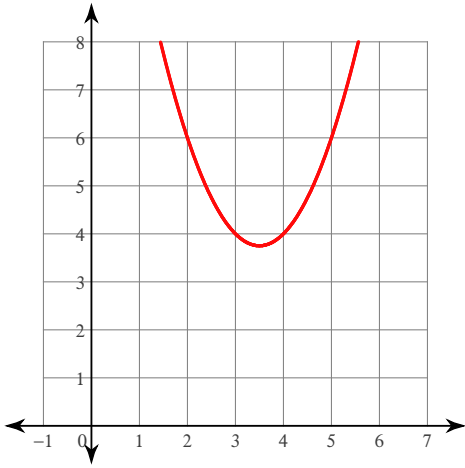
82) $y = x^2 - 5x + 7$



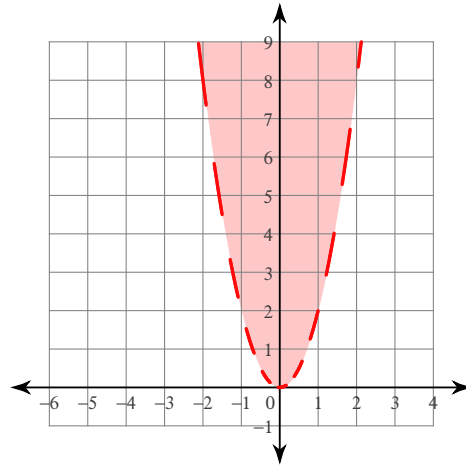
83) $y = x^2 - 5x + 3$



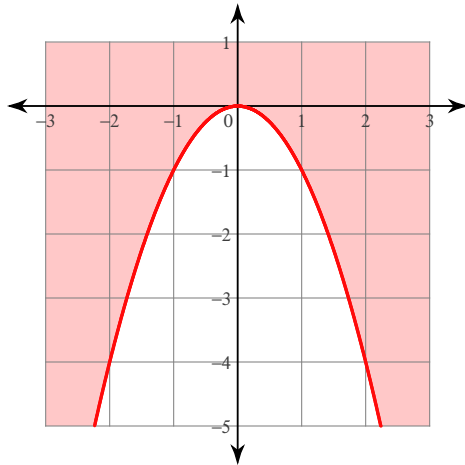
$$84) y = x^2 - 7x + 16$$



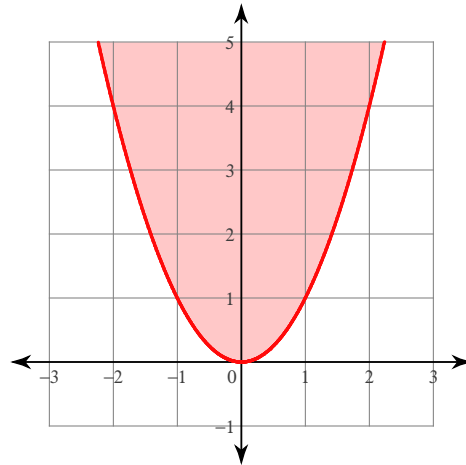
$$85) y > 2x^2$$



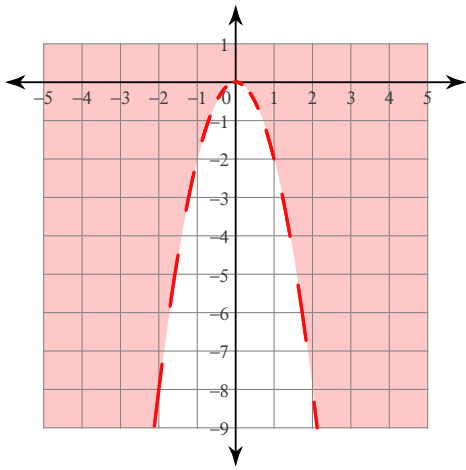
$$86) y \geq -x^2$$



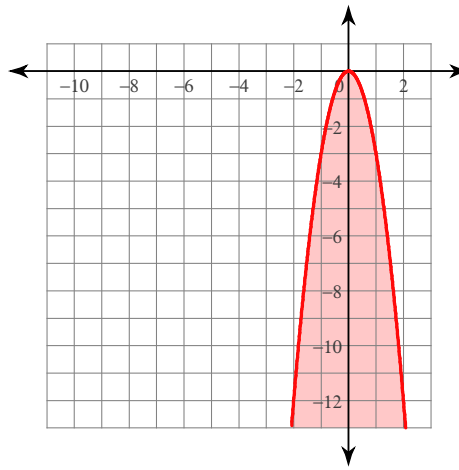
$$87) y \geq x^2$$



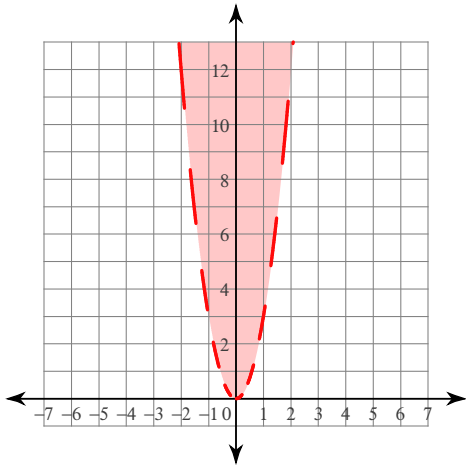
88) $y > -2x^2$



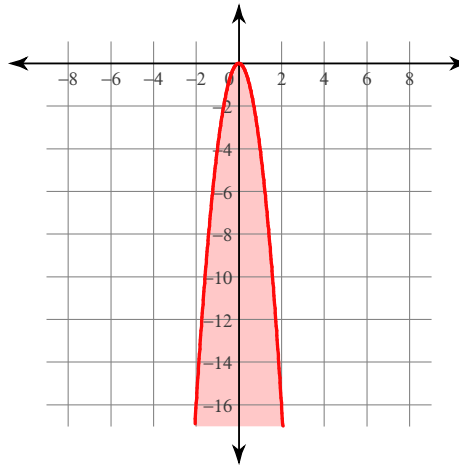
89) $y \leq -3x^2$



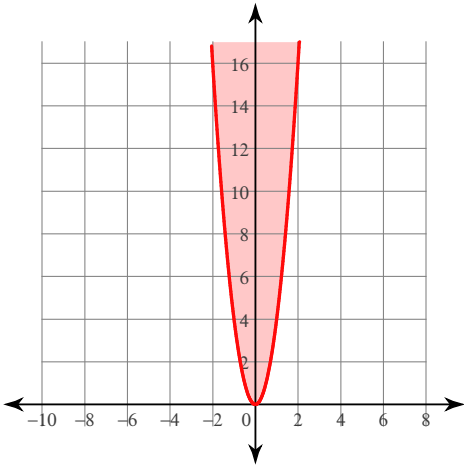
90) $y > 3x^2$



91) $y \leq -4x^2$

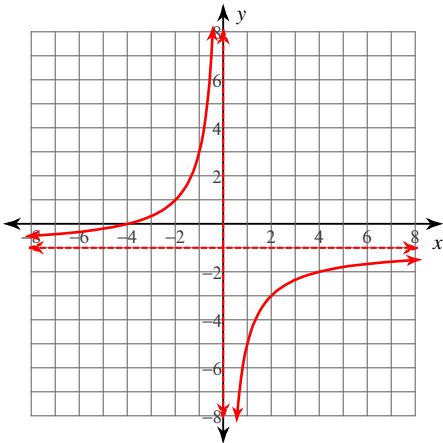


92) $y \geq 4x^2$

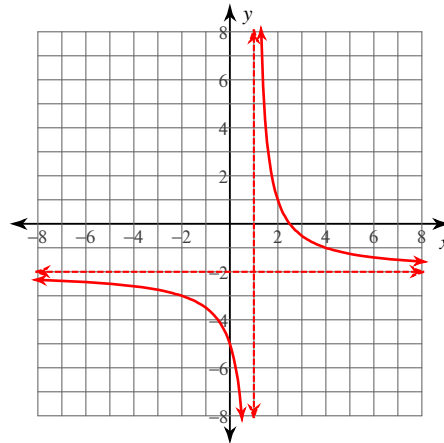


Graph each function.

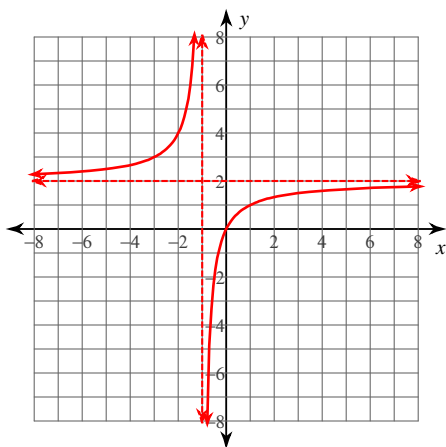
93) $f(x) = -\frac{4}{x} - 1$



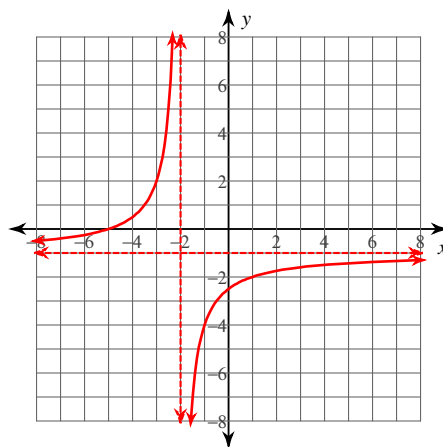
94) $f(x) = \frac{3}{x-1} - 2$



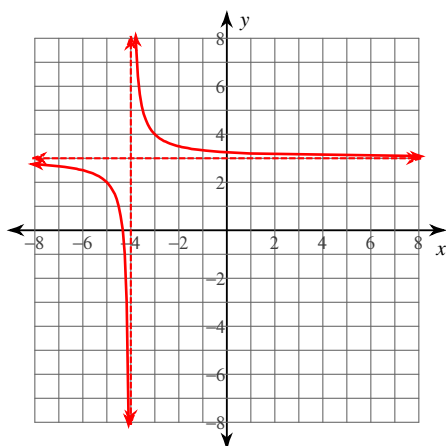
$$95) f(x) = -\frac{2}{x+1} + 2$$



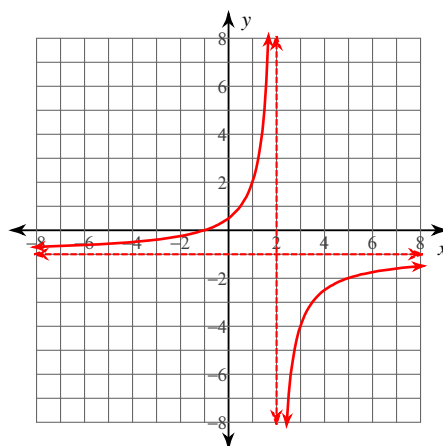
$$96) f(x) = -\frac{3}{x+2} - 1$$



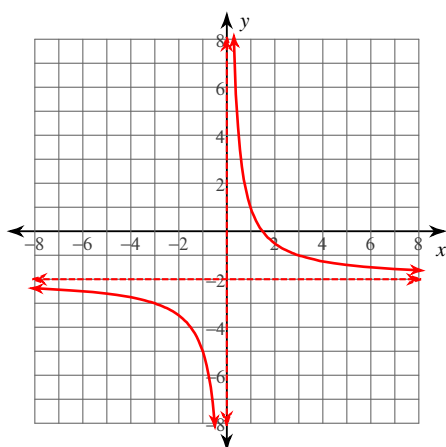
$$97) f(x) = \frac{1}{x+4} + 3$$



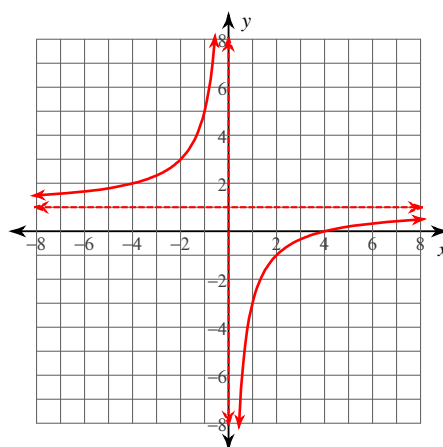
$$98) f(x) = -\frac{3}{x-2} - 1$$



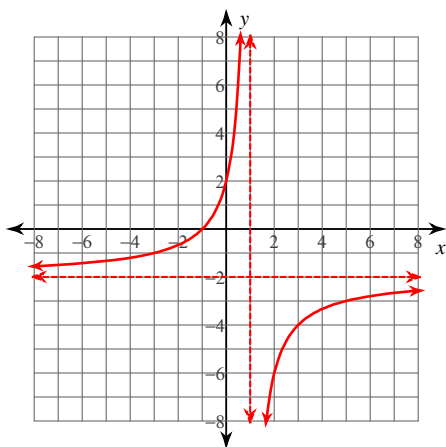
$$99) f(x) = \frac{3}{x} - 2$$



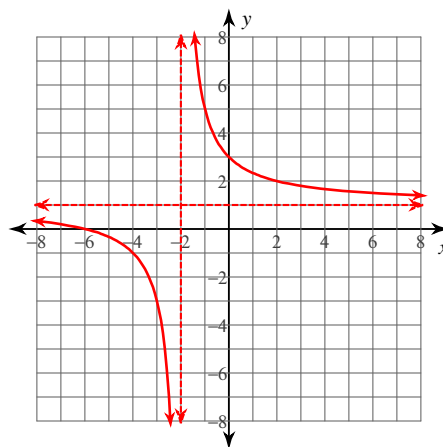
$$100) f(x) = -\frac{4}{x} + 1$$



$$101) f(x) = -\frac{4}{x-1} - 2$$

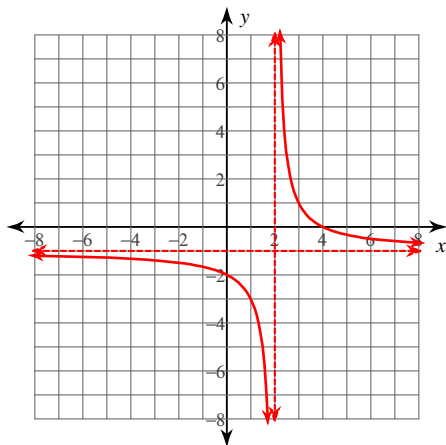


$$102) f(x) = \frac{4}{x+2} + 1$$



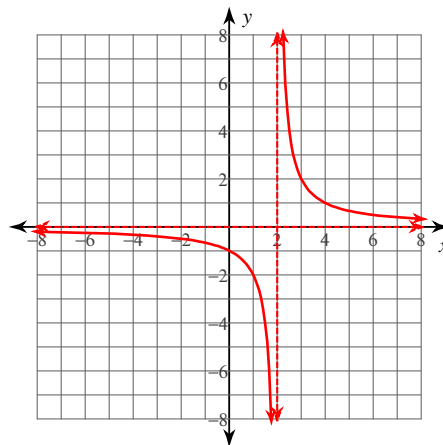
Identify the holes, vertical asymptotes, and horizontal asymptote of each. Then sketch the graph.

$$103) f(x) = \frac{2}{x-2} - 1$$



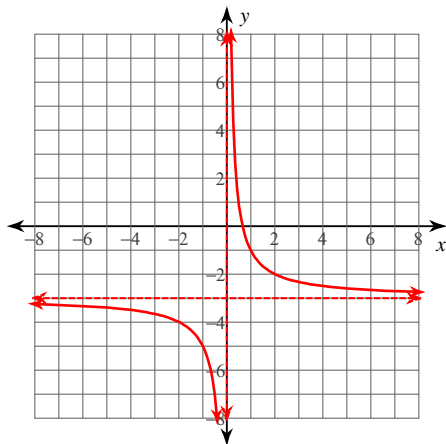
Vertical Asym.: $x = 2$
Holes: None
Horz. Asym.: $y = -1$

$$104) f(x) = \frac{2}{x-2}$$



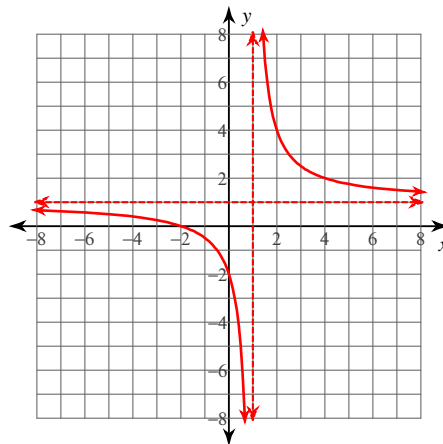
Vertical Asym.: $x = 2$
Holes: None
Horz. Asym.: $y = 0$

$$105) f(x) = \frac{2}{x} - 3$$



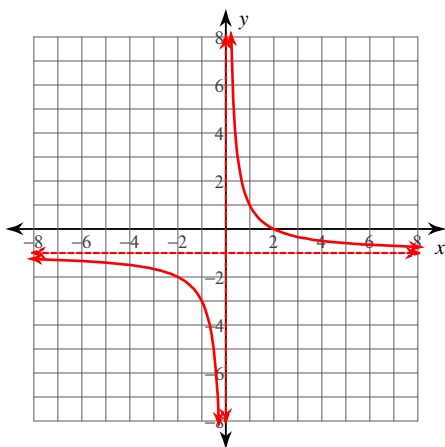
Vertical Asym.: $x = 0$
Holes: None
Horz. Asym.: $y = -3$

$$106) f(x) = \frac{3}{x-1} + 1$$



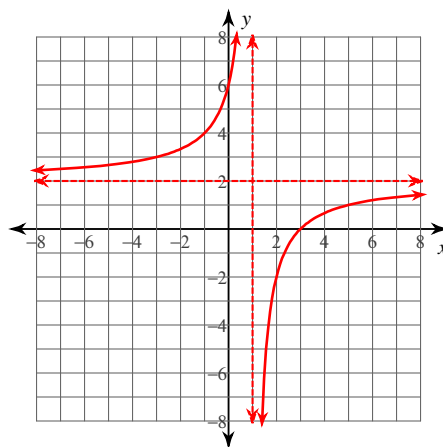
Vertical Asym.: $x = 1$
Holes: None
Horz. Asym.: $y = 1$

$$107) f(x) = \frac{2}{x} - 1$$



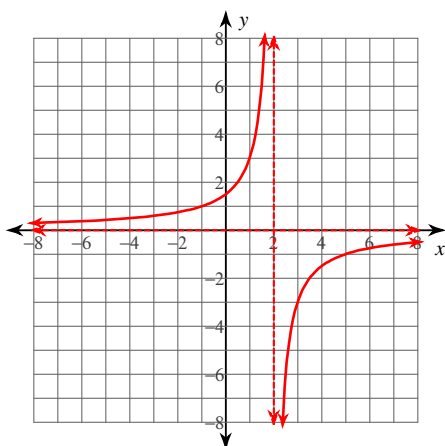
Vertical Asym.: $x = 0$
 Holes: None
 Horz. Asym.: $y = -1$

$$108) f(x) = -\frac{4}{x-1} + 2$$



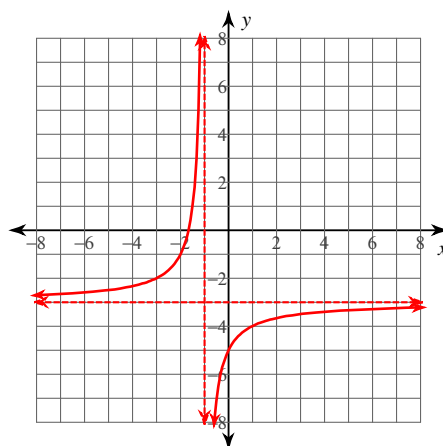
Vertical Asym.: $x = 1$
 Holes: None
 Horz. Asym.: $y = 2$

$$109) f(x) = -\frac{3}{x-2}$$



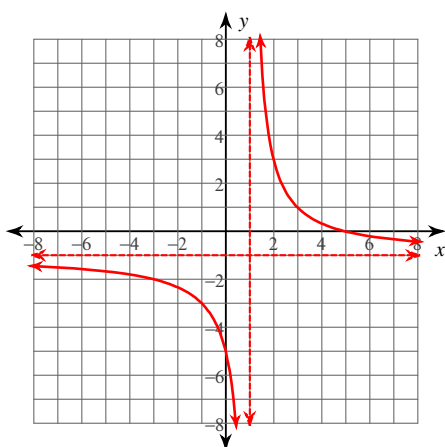
Vertical Asym.: $x = 2$
 Holes: None
 Horz. Asym.: $y = 0$

$$110) f(x) = -\frac{2}{x+1} - 3$$



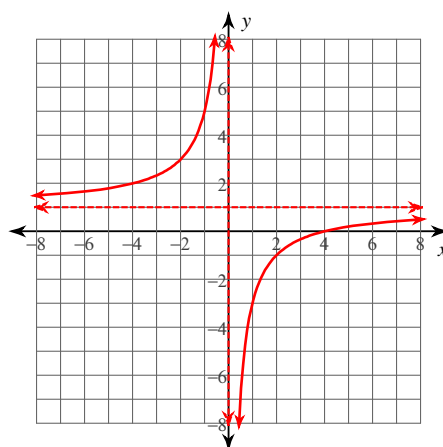
Vertical Asym.: $x = -1$
 Holes: None
 Horz. Asym.: $y = -3$

$$111) f(x) = \frac{4}{x-1} - 1$$



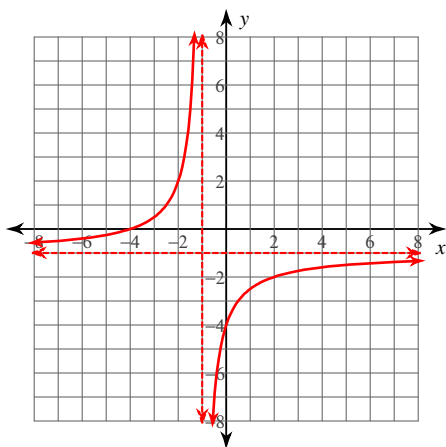
Vertical Asym.: $x = 1$
 Holes: None
 Horz. Asym.: $y = -1$

$$112) f(x) = -\frac{4}{x} + 1$$



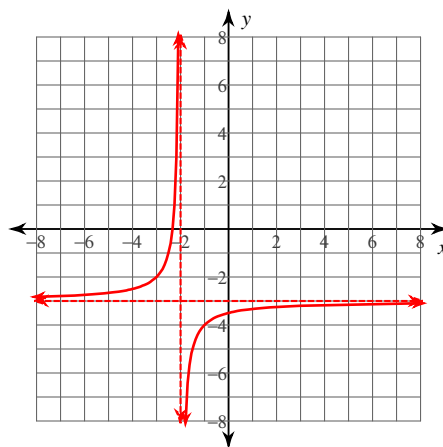
Vertical Asym.: $x = 0$
 Holes: None
 Horz. Asym.: $y = 1$

$$113) f(x) = -\frac{3}{x+1} - 1$$



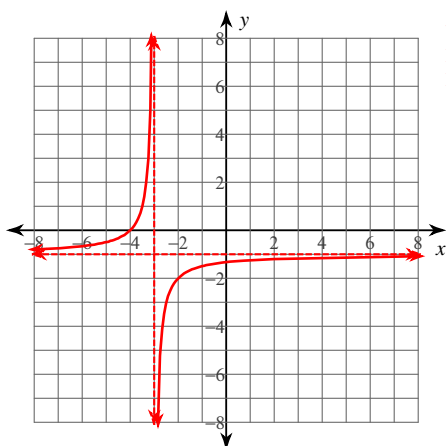
Vertical Asym.: $x = -1$
Holes: None
Horz. Asym.: $y = -1$

$$114) f(x) = -\frac{1}{x+2} - 3$$



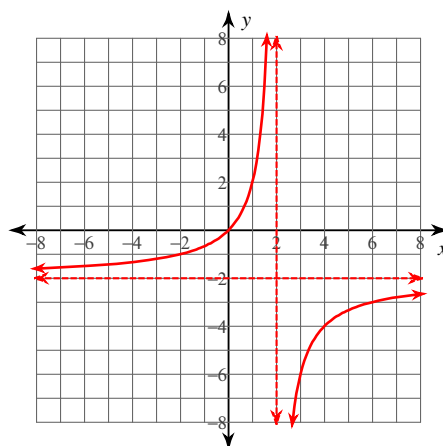
Vertical Asym.: $x = -2$
Holes: None
Horz. Asym.: $y = -3$

$$115) f(x) = -\frac{1}{x+3} - 1$$



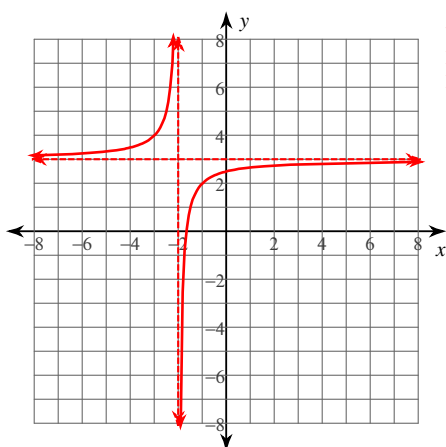
Vertical Asym.: $x = -3$
Holes: None
Horz. Asym.: $y = -1$

$$116) f(x) = -\frac{4}{x-2} - 2$$



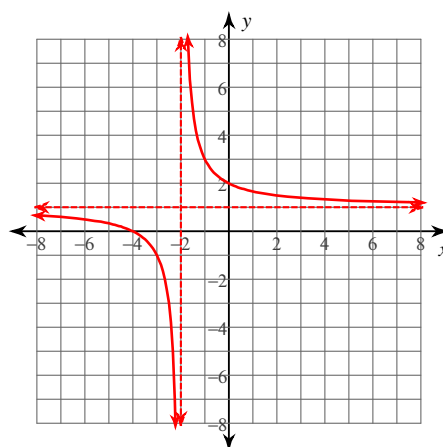
Vertical Asym.: $x = 2$
Holes: None
Horz. Asym.: $y = -2$

$$117) f(x) = -\frac{1}{x+2} + 3$$



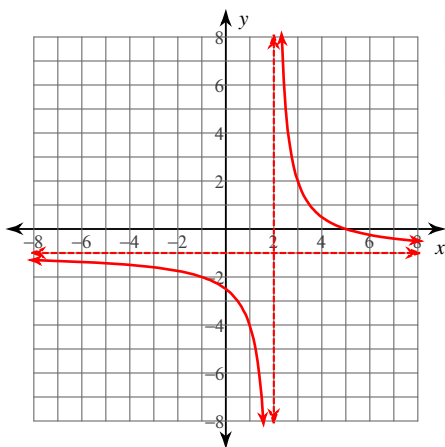
Vertical Asym.: $x = -2$
Holes: None
Horz. Asym.: $y = 3$

$$118) f(x) = \frac{2}{x+2} + 1$$



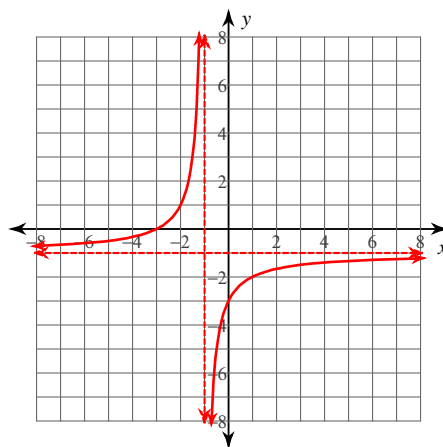
Vertical Asym.: $x = -2$
Holes: None
Horz. Asym.: $y = 1$

$$119) f(x) = \frac{3}{x-2} - 1$$



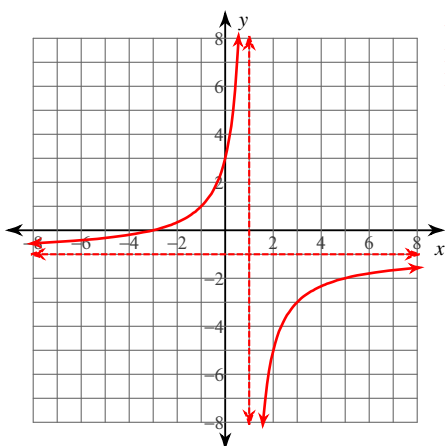
Vertical Asym.: $x = 2$
 Holes: None
 Horz. Asym.: $y = -1$

$$120) f(x) = -\frac{2}{x+1} - 1$$



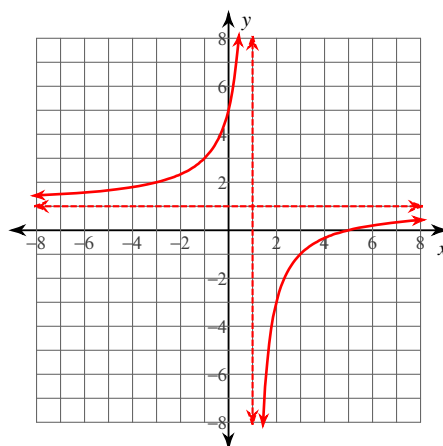
Vertical Asym.: $x = -1$
 Holes: None
 Horz. Asym.: $y = -1$

$$121) f(x) = -\frac{4}{x-1} - 1$$



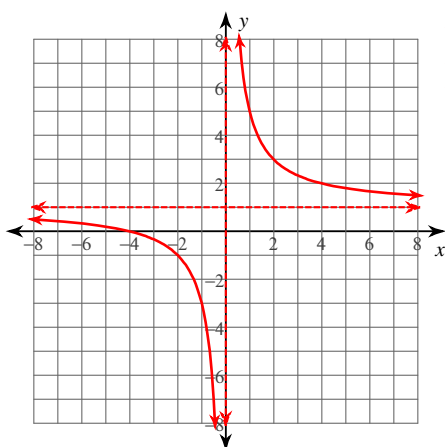
Vertical Asym.: $x = 1$
 Holes: None
 Horz. Asym.: $y = -1$

$$122) f(x) = -\frac{4}{x-1} + 1$$



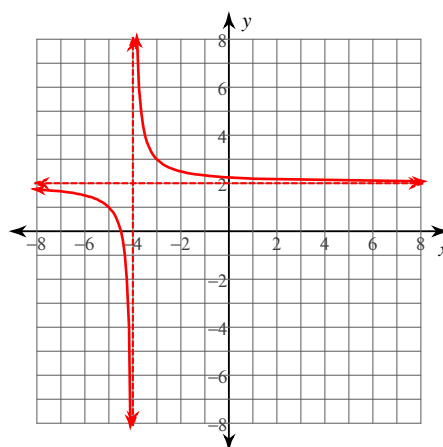
Vertical Asym.: $x = 1$
 Holes: None
 Horz. Asym.: $y = 1$

$$123) f(x) = \frac{4}{x} + 1$$



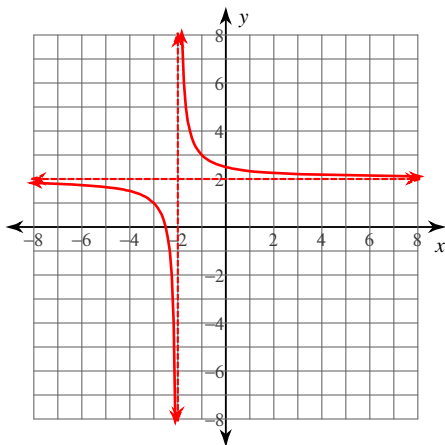
Vertical Asym.: $x = 0$
 Holes: None
 Horz. Asym.: $y = 1$

$$124) f(x) = \frac{1}{x+4} + 2$$



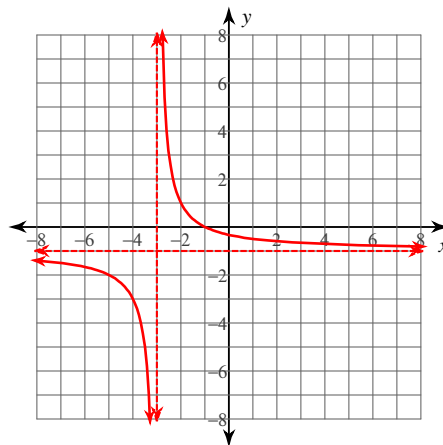
Vertical Asym.: $x = -4$
 Holes: None
 Horz. Asym.: $y = 2$

$$125) f(x) = \frac{1}{x+2} + 2$$



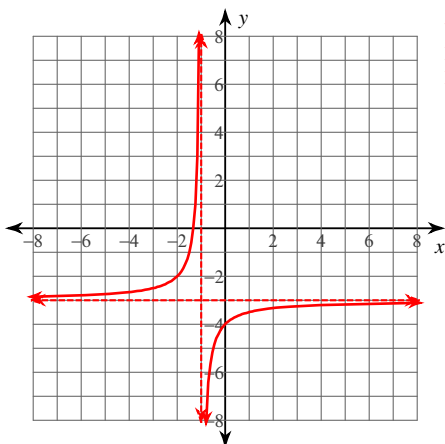
Vertical Asym.: $x = -2$
Holes: None
Horz. Asym.: $y = 2$

$$126) f(x) = \frac{2}{x+3} - 1$$



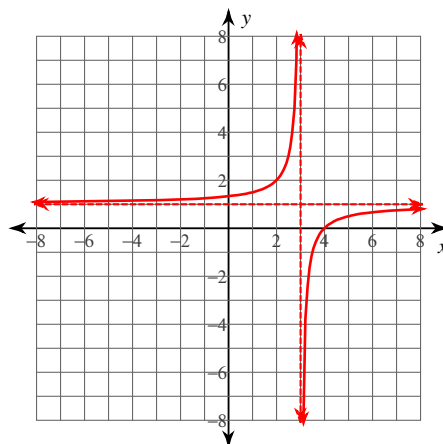
Vertical Asym.: $x = -3$
Holes: None
Horz. Asym.: $y = -1$

$$127) f(x) = -\frac{1}{x+1} - 3$$



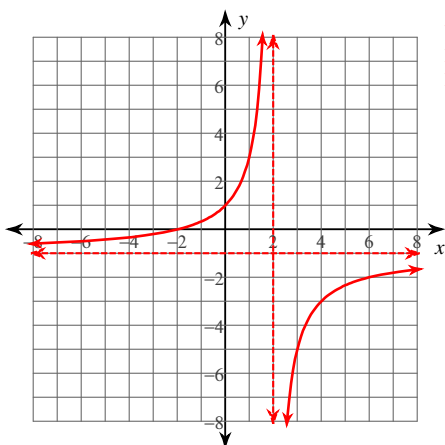
Vertical Asym.: $x = -1$
Holes: None
Horz. Asym.: $y = -3$

$$128) f(x) = -\frac{1}{x-3} + 1$$



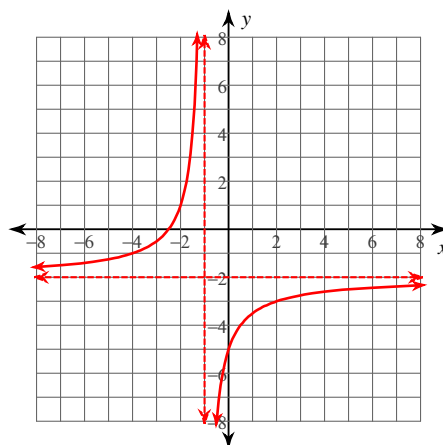
Vertical Asym.: $x = 3$
Holes: None
Horz. Asym.: $y = 1$

$$129) f(x) = -\frac{4}{x-2} - 1$$



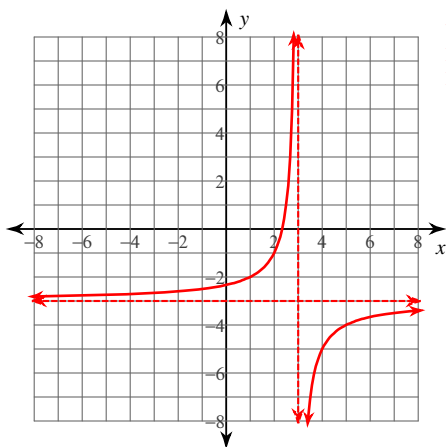
Vertical Asym.: $x = 2$
Holes: None
Horz. Asym.: $y = -1$

$$130) f(x) = -\frac{3}{x+1} - 2$$



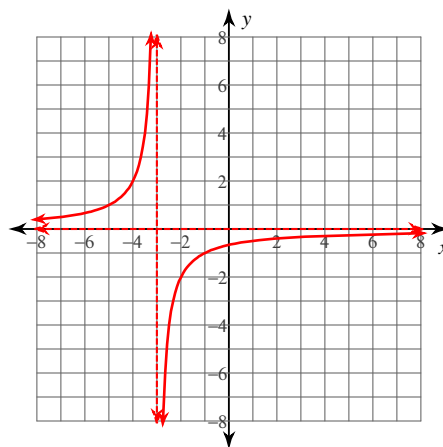
Vertical Asym.: $x = -1$
Holes: None
Horz. Asym.: $y = -2$

$$131) f(x) = -\frac{2}{x-3} - 3$$



Vertical Asym.: $x = 3$
Holes: None
Horz. Asym.: $y = -3$

$$132) f(x) = -\frac{2}{x+3}$$



Vertical Asym.: $x = -3$
Holes: None
Horz. Asym.: $y = 0$

Describe the end behavior of each function.

$$133) f(x) = -x^4 + 2x^2 + x - 3 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array} \quad 134) f(x) = -2x^2 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$135) f(x) = x^3 - 2x^2 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array} \quad 136) f(x) = x^4 - 2x^2 - x - 3 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$137) f(x) = x^4 - 2x^2 - 2x + 2 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array} \quad 138) f(x) = -2x^2 + 4x \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$139) f(x) = -x^4 + 4x^3 - 3x^2 - 2x \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array} \quad 140) f(x) = x^4 - x^2 + x - 3 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$141) f(x) = -x^2 + 8x - 13 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array} \quad 142) f(x) = x^2 - 6x + 8 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$143) f(x) = x^4 - x^3 - 3x^2 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array} \quad 144) f(x) = x^3 - 3x^2 + 3 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$145) f(x) = -x^3 + 4x^2 - 7 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array} \quad 146) f(x) = -2x^2 - 8x - 6 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$147) f(x) = x^4 + 4x^3 + 2x^2 - 5x - 4 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array} \quad 148) f(x) = x^3 - 2x^2 - 1 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$149) f(x) = x^4 - 2x^2 - x + 4 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array} \quad 150) f(x) = 2x^2 - 8x + 8 \quad \begin{array}{l} f(x) \rightarrow +\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow +\infty \text{ as } x \rightarrow +\infty \end{array}$$

$$151) f(x) = -x^4 + x^3 + x^2 + 4 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array} \quad 152) f(x) = -x^4 + x^2 - x + 1 \quad \begin{array}{l} f(x) \rightarrow -\infty \text{ as } x \rightarrow -\infty \\ f(x) \rightarrow -\infty \text{ as } x \rightarrow +\infty \end{array}$$

