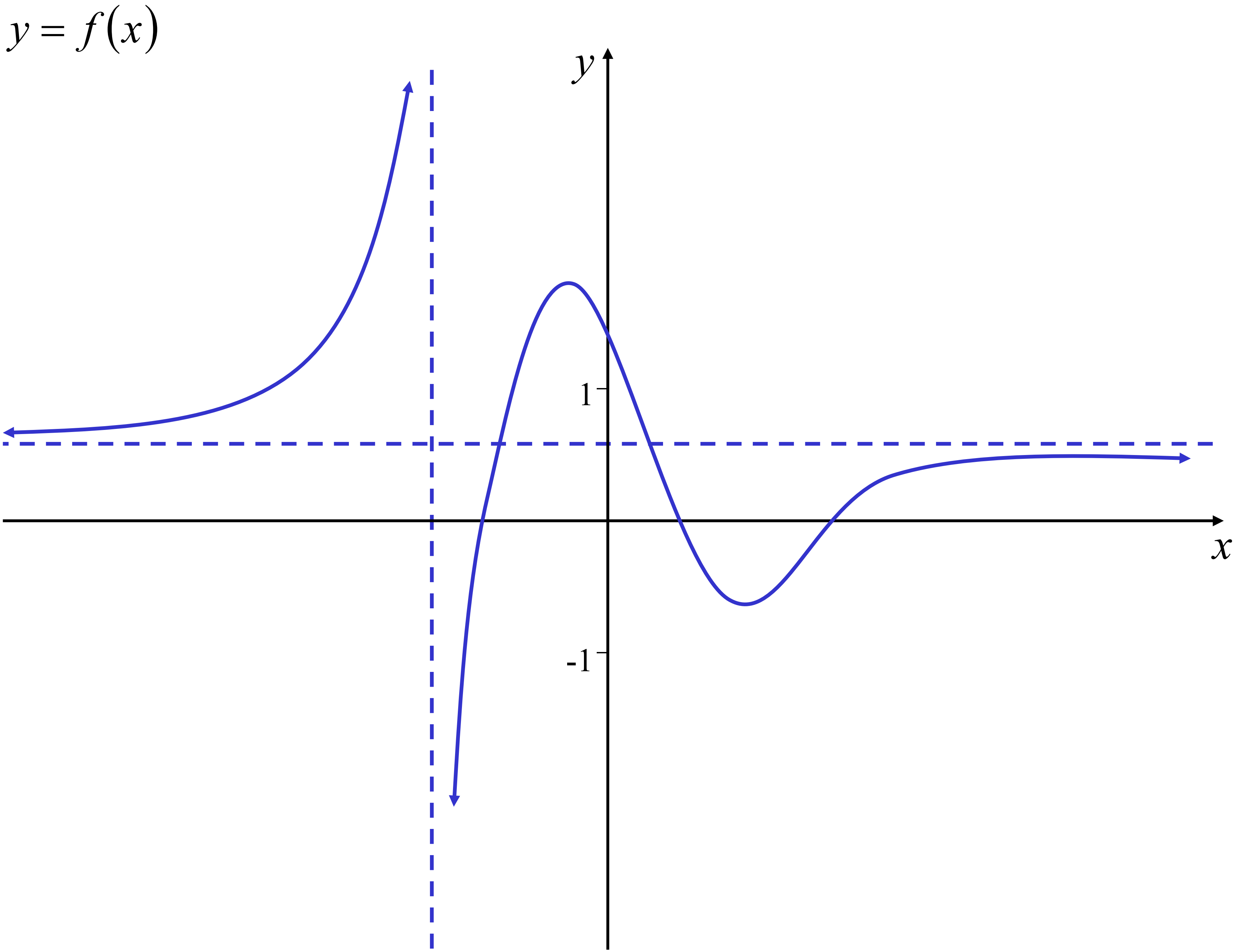
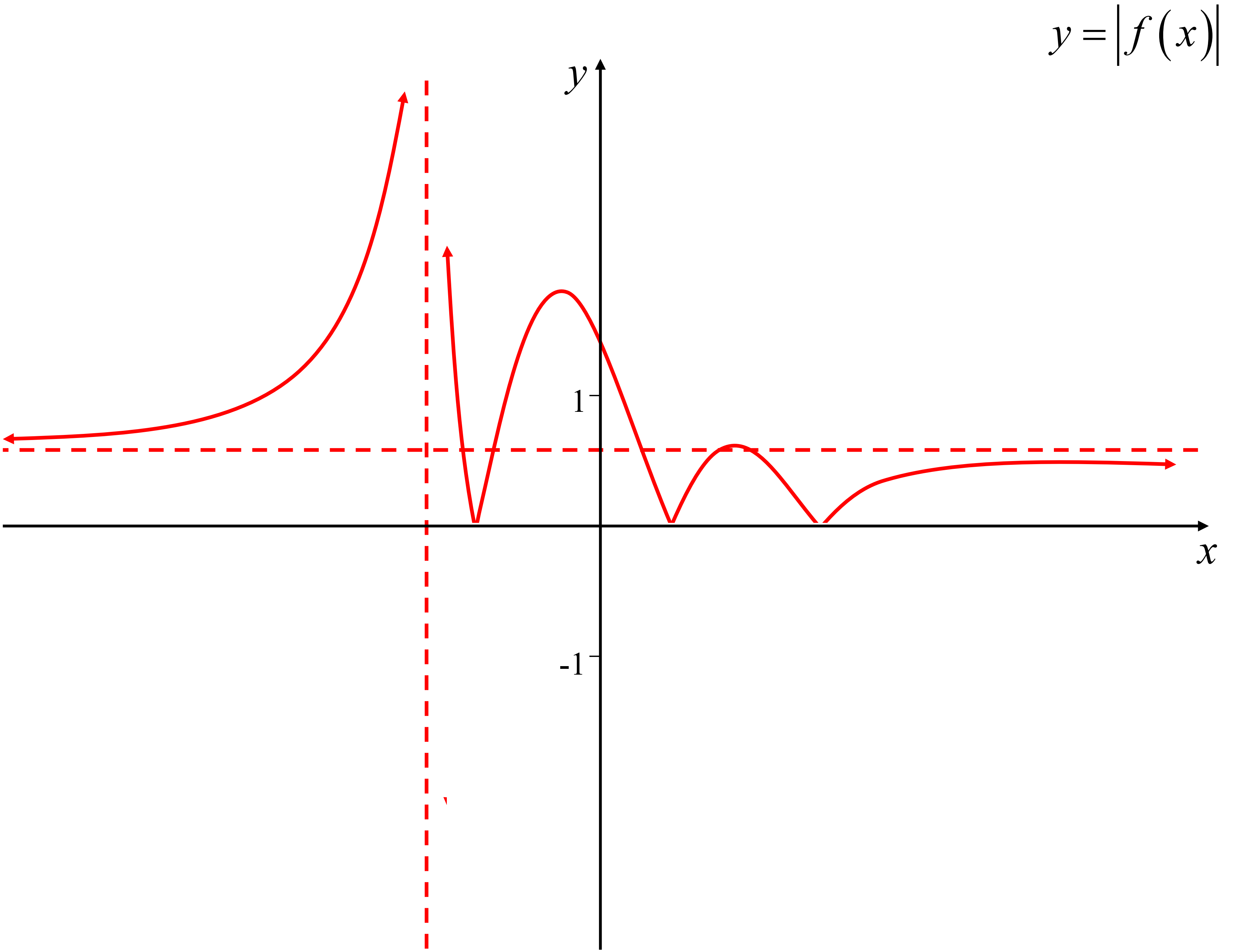
Graphs of Absolute Value Functions

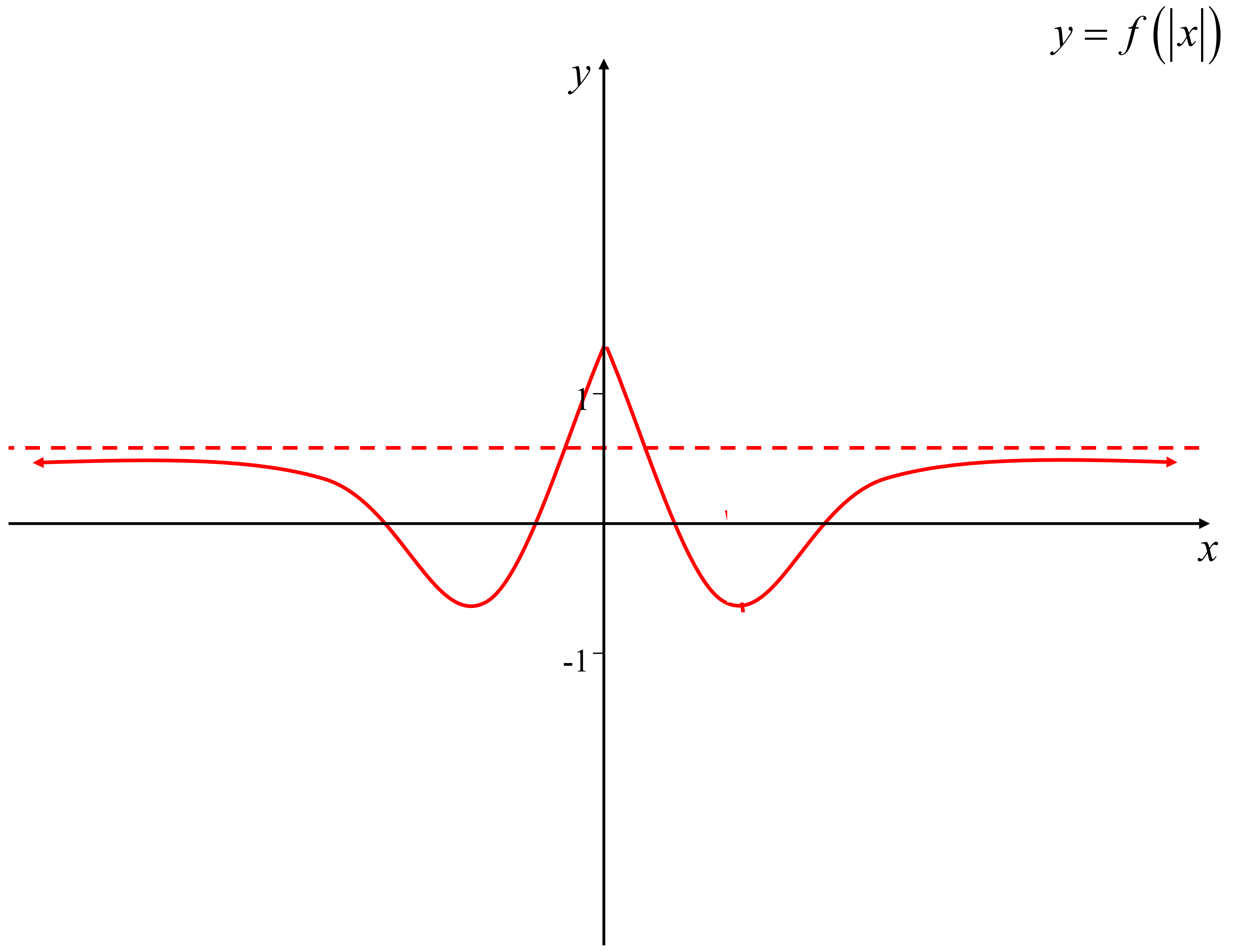
- $y = |f(x)|$ (*reflection in the x axis*)
  (*reflect the part of f(x) where f(x)<0 in the x axis*)
- $y = f(|x|)$ (*symmetry in the y axis*)
  (*reflect the part of f(x) where x>0 in the y axis*)
- $|y| = f(x)$ (*symmetry in the x axis*)
  (*reflect the part of f(x) where f(x)>0 in the x axis*)
- $|y| = f(|x|)$ (*symmetry in the x and y axes*)
  (*reflect the part of f(x) in the 1st quadrant into all four quadrants*)
- $y = |f(|x|)|$ (*symmetry in the y axis and reflection in the x axis*)
  (*reflect the part of f(x) where x>0 in the y axis, then reflect result in the y axis*)
- $|y| = |f(x)|$ (*symmetry in the x axis and reflection in the x axis*)
  (*reflect the part of f(x) where f(x)<0 in the x axis, then reflect result in the x axis*)

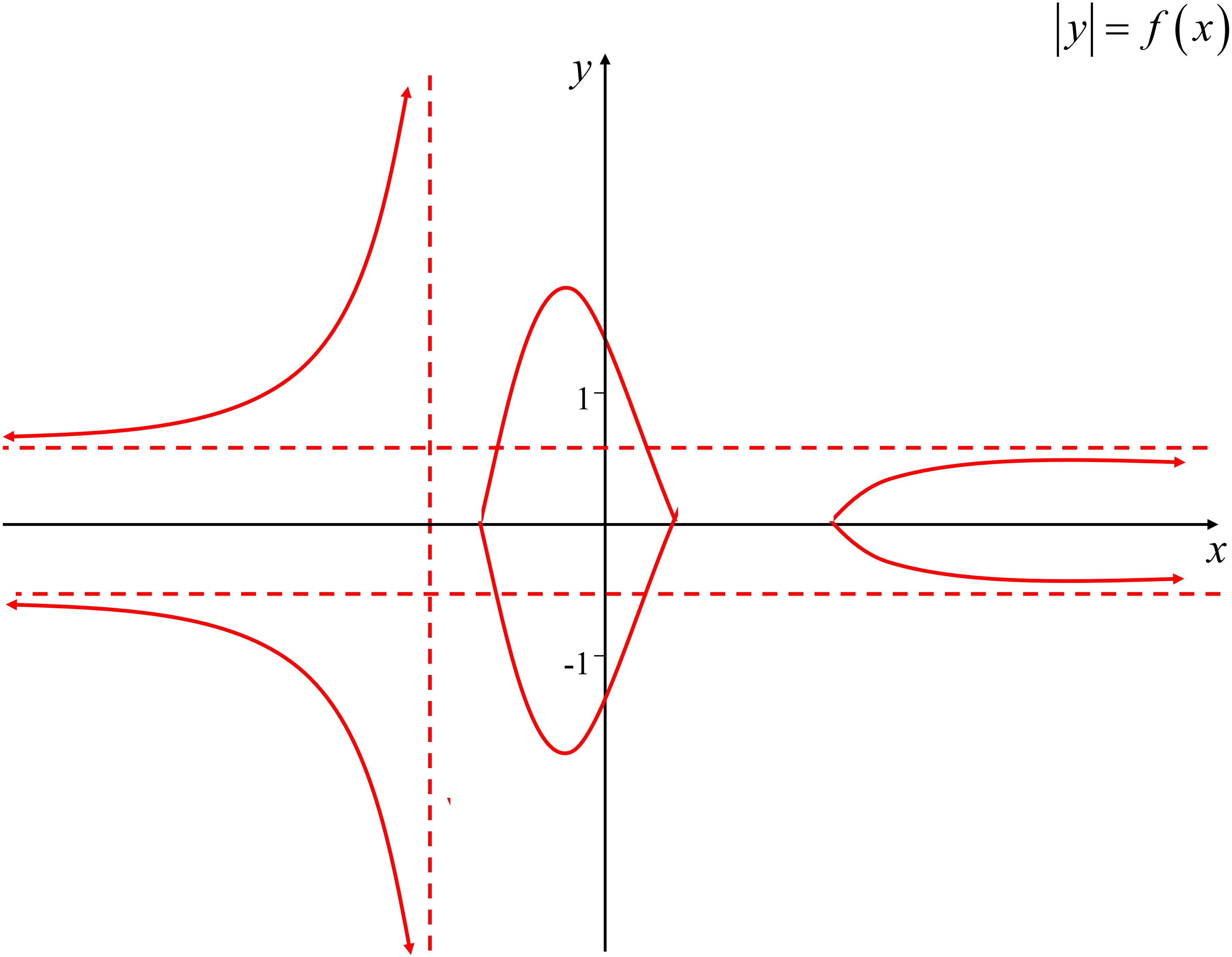


$y = f(x)$
y
x
1
-1



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

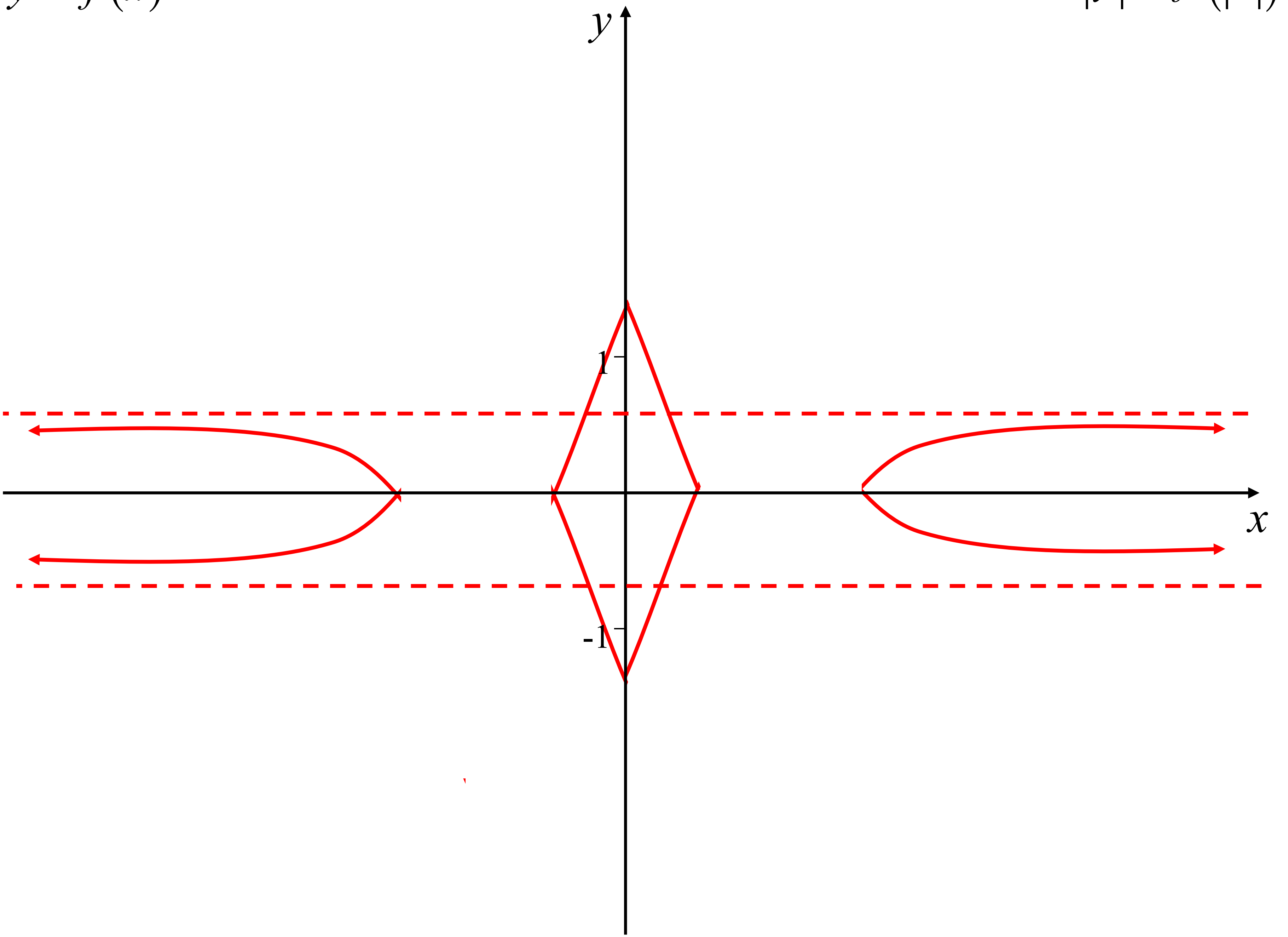

$y = f\left(\left|x\right|\right)$
y
x
1
-1



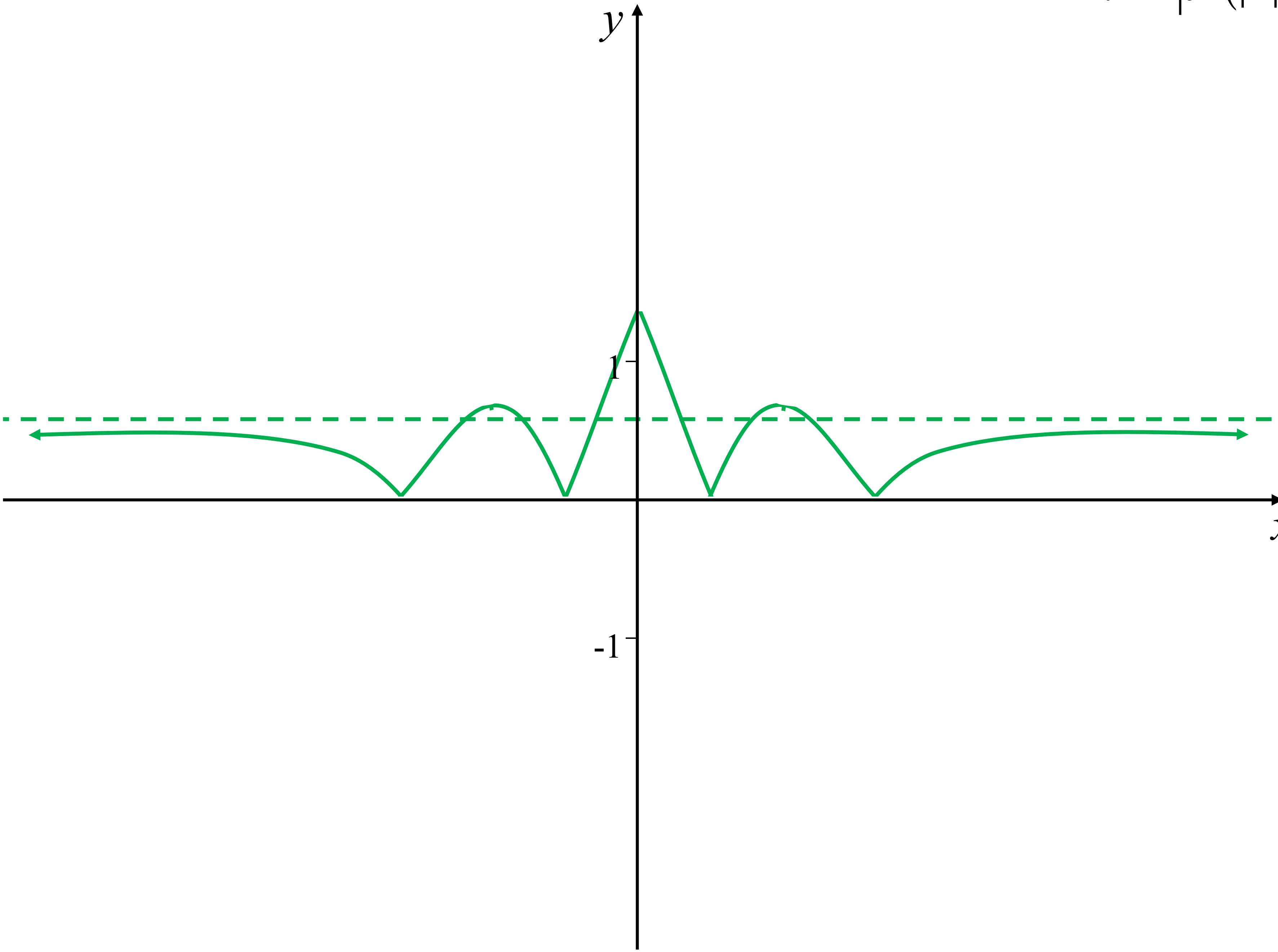
$|y| = f(x)$
y
x
1
-1

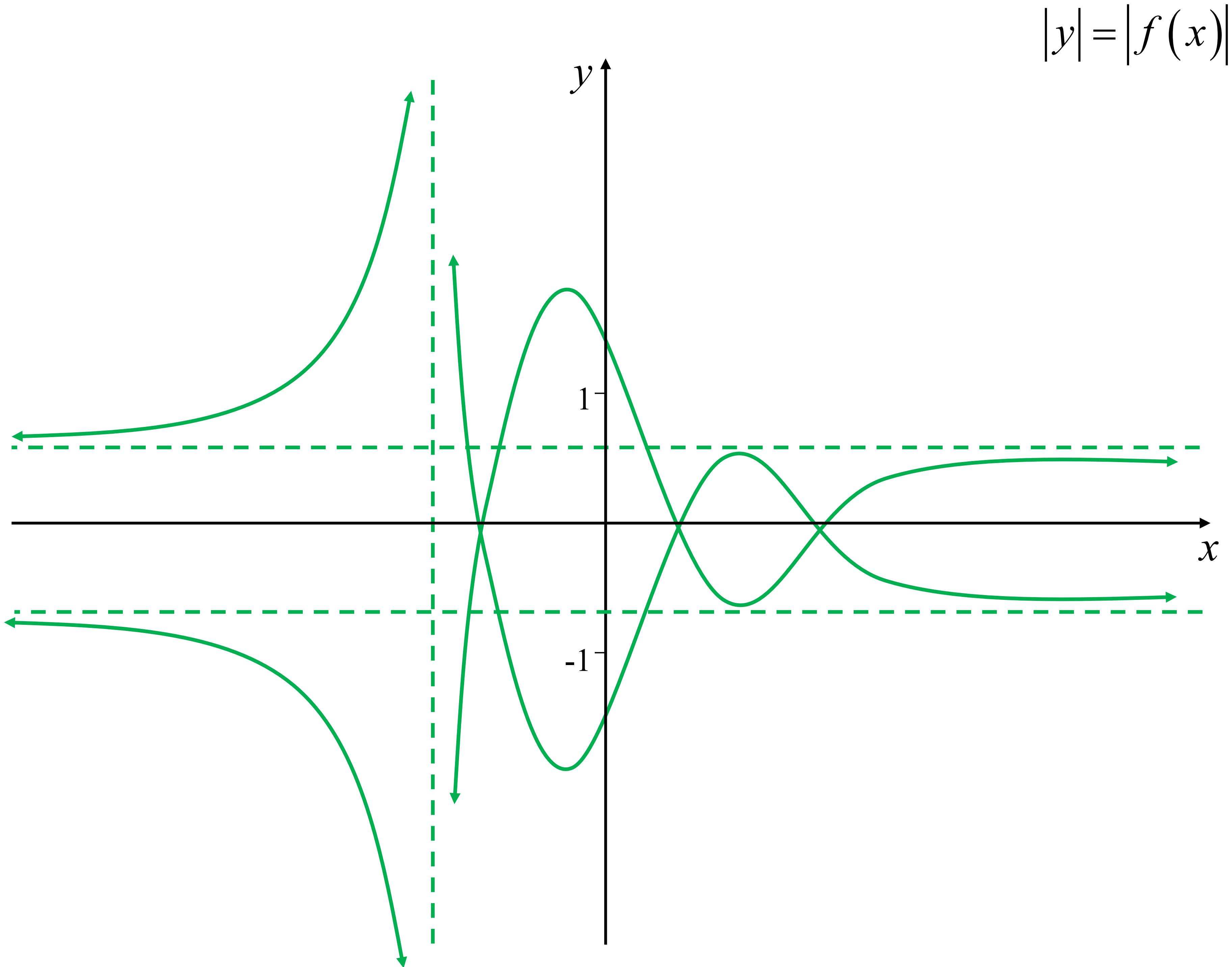
$y = f(x)$

$|y| = f(|x|)$



$y = \left| f\left(\left| x \right| \right) \right|$





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

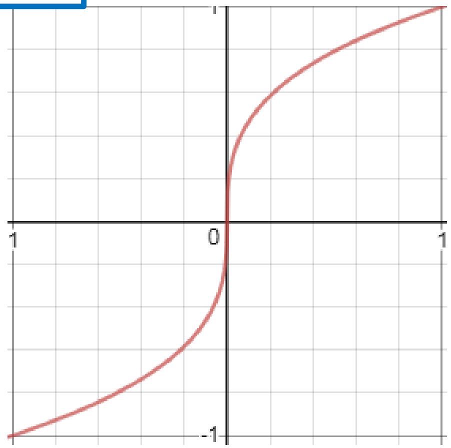
Graphs of the Form $y=\sqrt{f(x)}$

The graph of $y=\sqrt{f(x)}$ can be sketched by first drawing $y=f(x)$ and noticing;

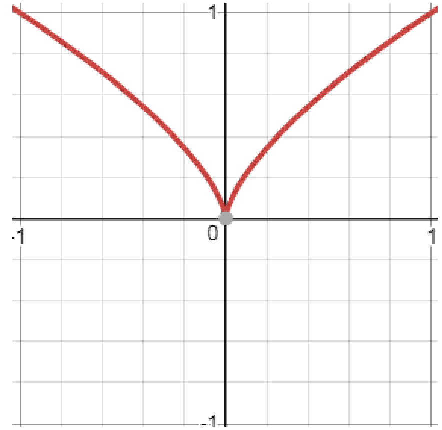
- $\sqrt{f(x)}$ is only defined if $f(x)\geq 0$
- $\sqrt{f(x)}\geq 0$ for all x in the domain
- stationary points must still be stationary points
- all discontinuities will remain
- horizontal and oblique asymptotes may change (root their value)
- $\sqrt{f(x)}<f(x)$ if $f(x)>1$ i.e. new curve is below old curve
- $\sqrt{f(x)}>f(x)$ if $f(x)<1$ i.e. new curve is above old curve
- x intercepts require close inspection

$$y = x^{\frac{a}{b}}$$

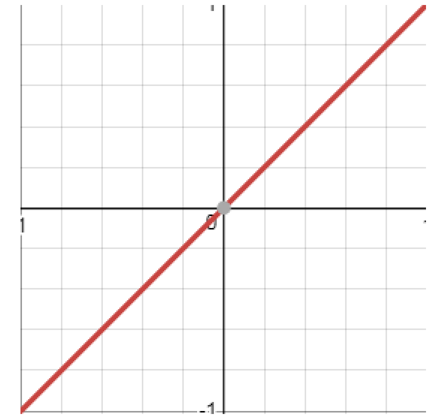
$$y = x^{\frac{1}{3}}$$



$$y = x^{\frac{2}{3}}$$

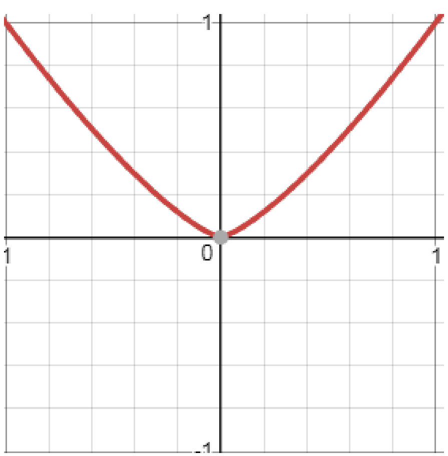


$$y = x^{\frac{3}{3}}$$

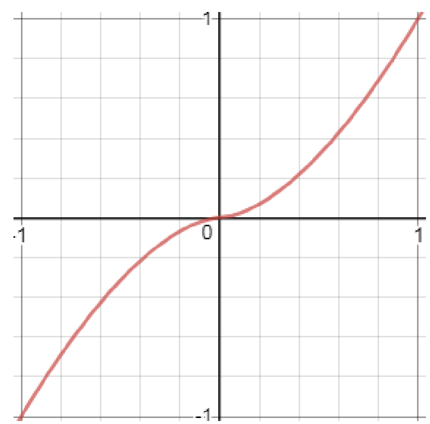


$\frac{a}{b} < 1$ curve is concave down in 1st quadrant (vertical tangent)

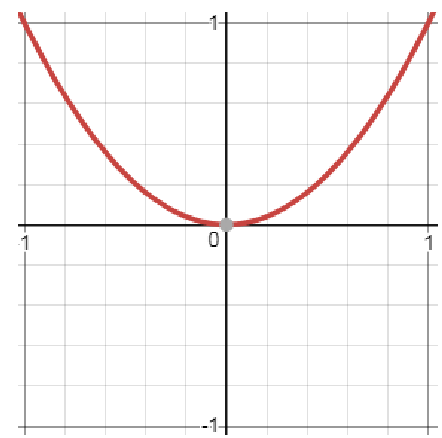
$$y = x^{\frac{4}{3}}$$



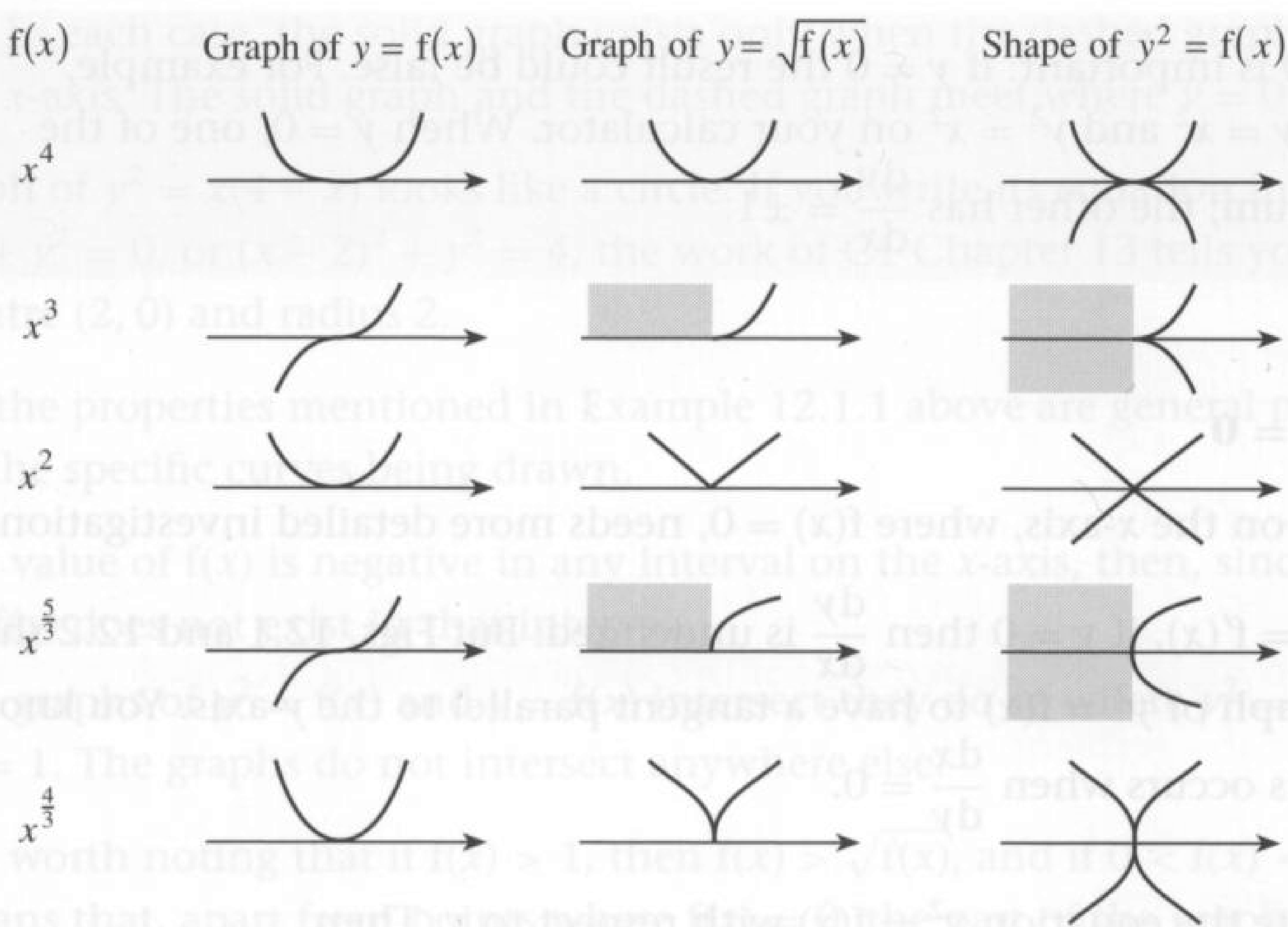
$$y = x^{\frac{5}{3}}$$



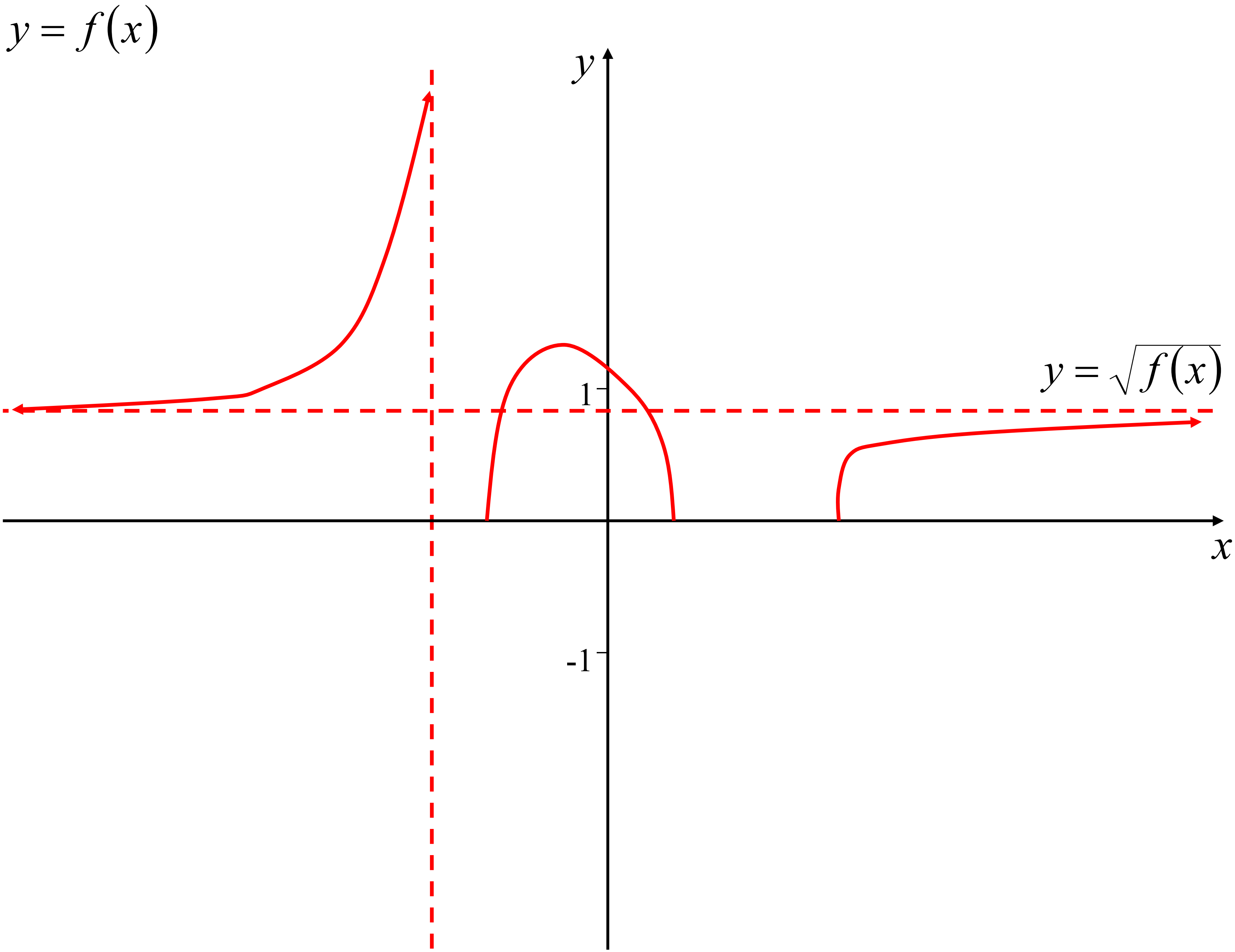
$$y = x^{\frac{6}{3}}$$



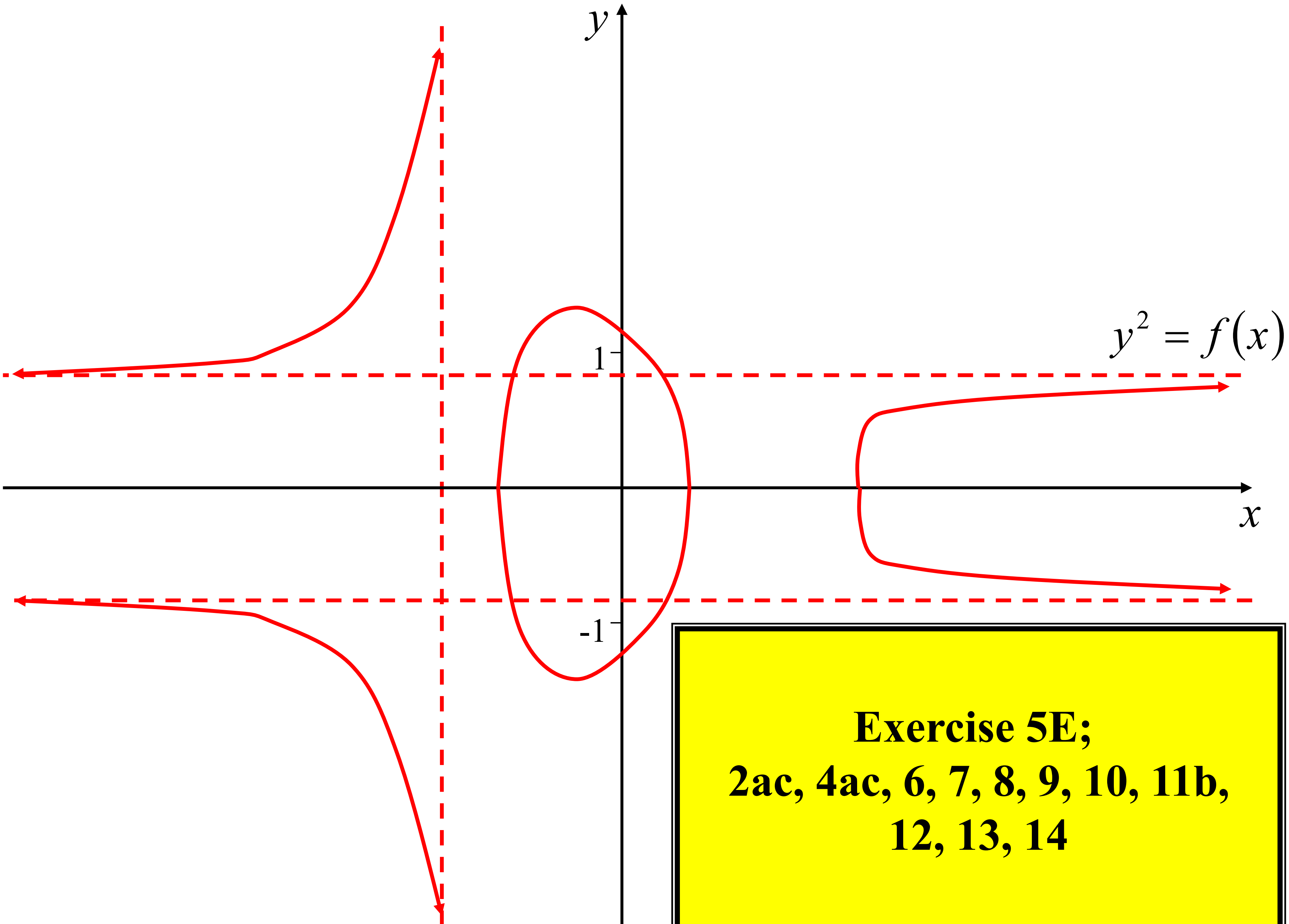
$\frac{a}{b} > 1$ curve is concave up in 1st quadrant (horizontal tangent)



$f(x)$
Graph of $y = f(x)$
Graph of $y = \sqrt{f(x)}$
Shape of $y^2 = f(x)$
x^4
x^3
x^2
$x^{\frac{5}{3}}$
$x^{\frac{4}{3}}$



y = f(x)
y
1
-1
x
y = √f(x)



Exercise 5E;
2ac, 4ac, 6, 7, 8, 9, 10, 11b, 12, 13, 14