

(C) Transformations

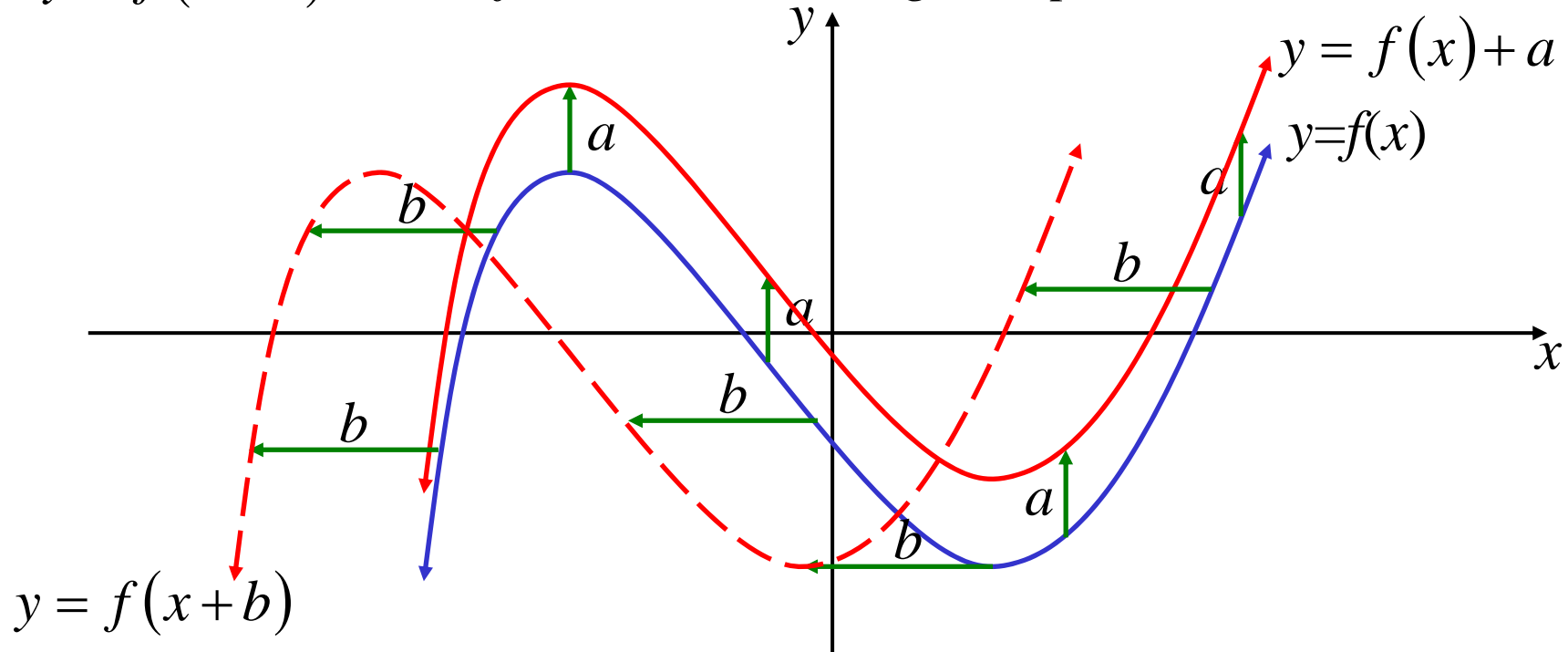
Given that the graph $y = f(x)$ can be sketches, then it is possible to build other sketches through appropriate transformations.

1. Shifting Curves

- $y = f(x) \pm a$ OR $y \mp a = f(x)$

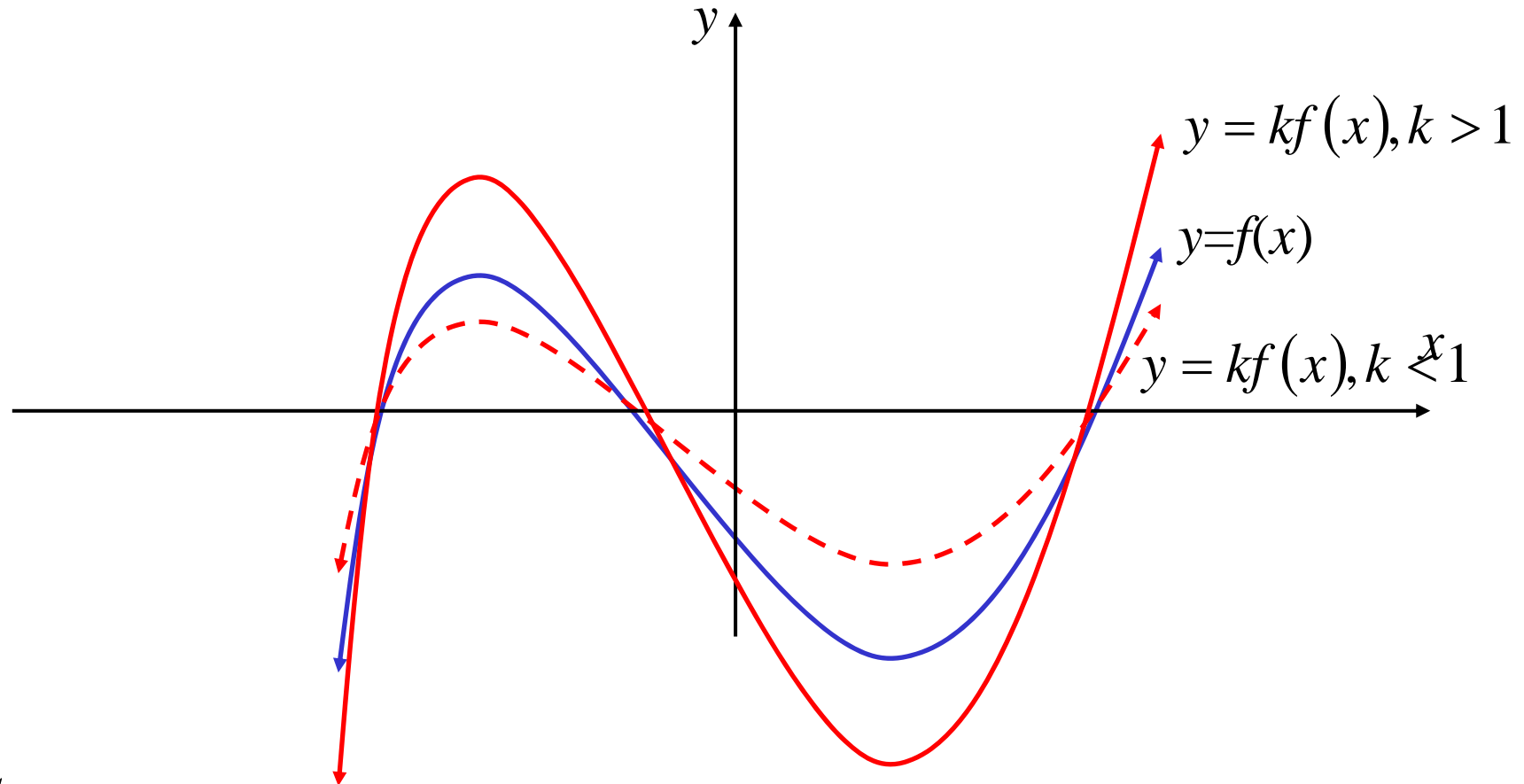
(to shift a units up, replace y with $y - a$)

- $y = f(x \pm a)$ *(to shift a units to the right, replace x with $x - a$)*



2. Stretching Curves

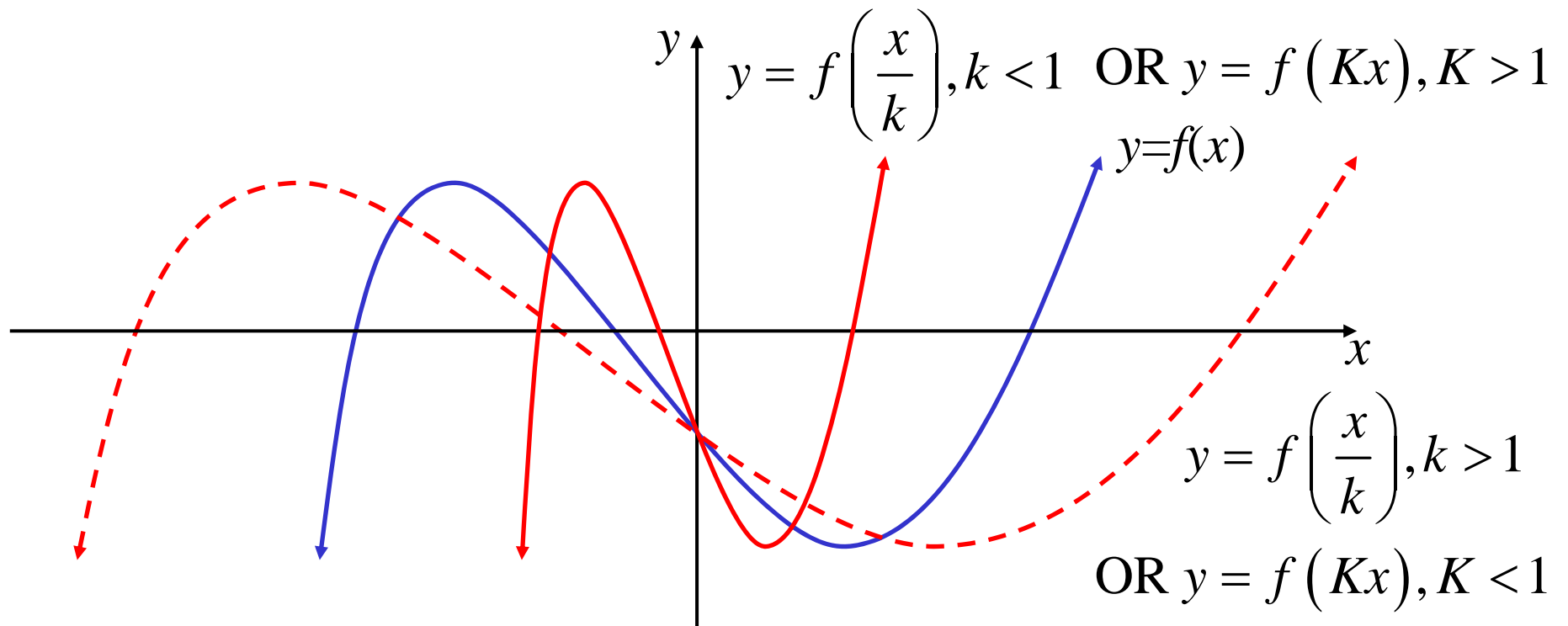
- $y = kf(x)$ (to stretch vertically by factor k , replace y with $\frac{y}{k}$)
($k < 1$ shallower, $k > 1$ steeper)



Note:

- domain remains same
- x values of key points remain the same
- x intercepts remain same

- $y = f\left(\frac{x}{k}\right)$ (to stretch horizontally by factor k , replace x with $\frac{x}{k}$)
($k < 1$ steeper, $k > 1$ shallower)

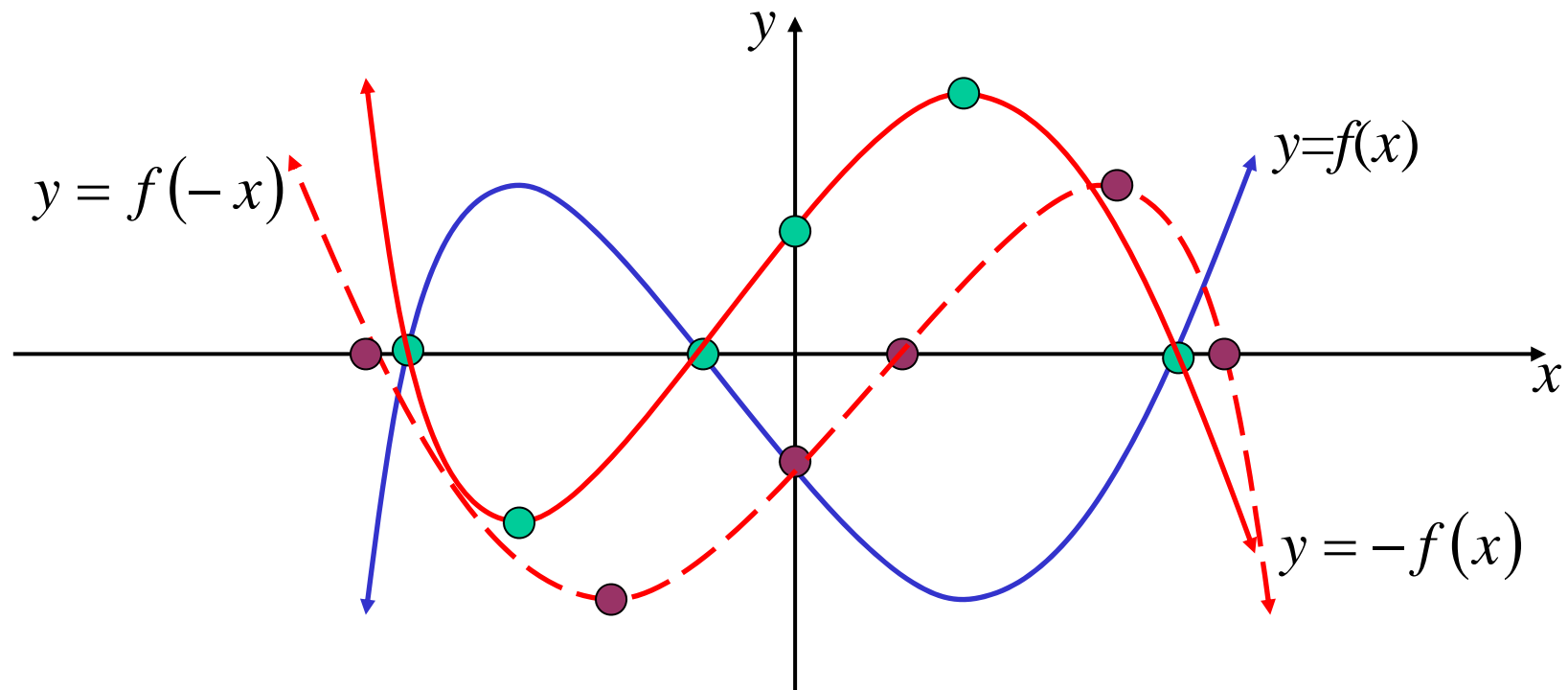


Note:

- range remains same
- y values of key points remain the same
- y intercepts remain same

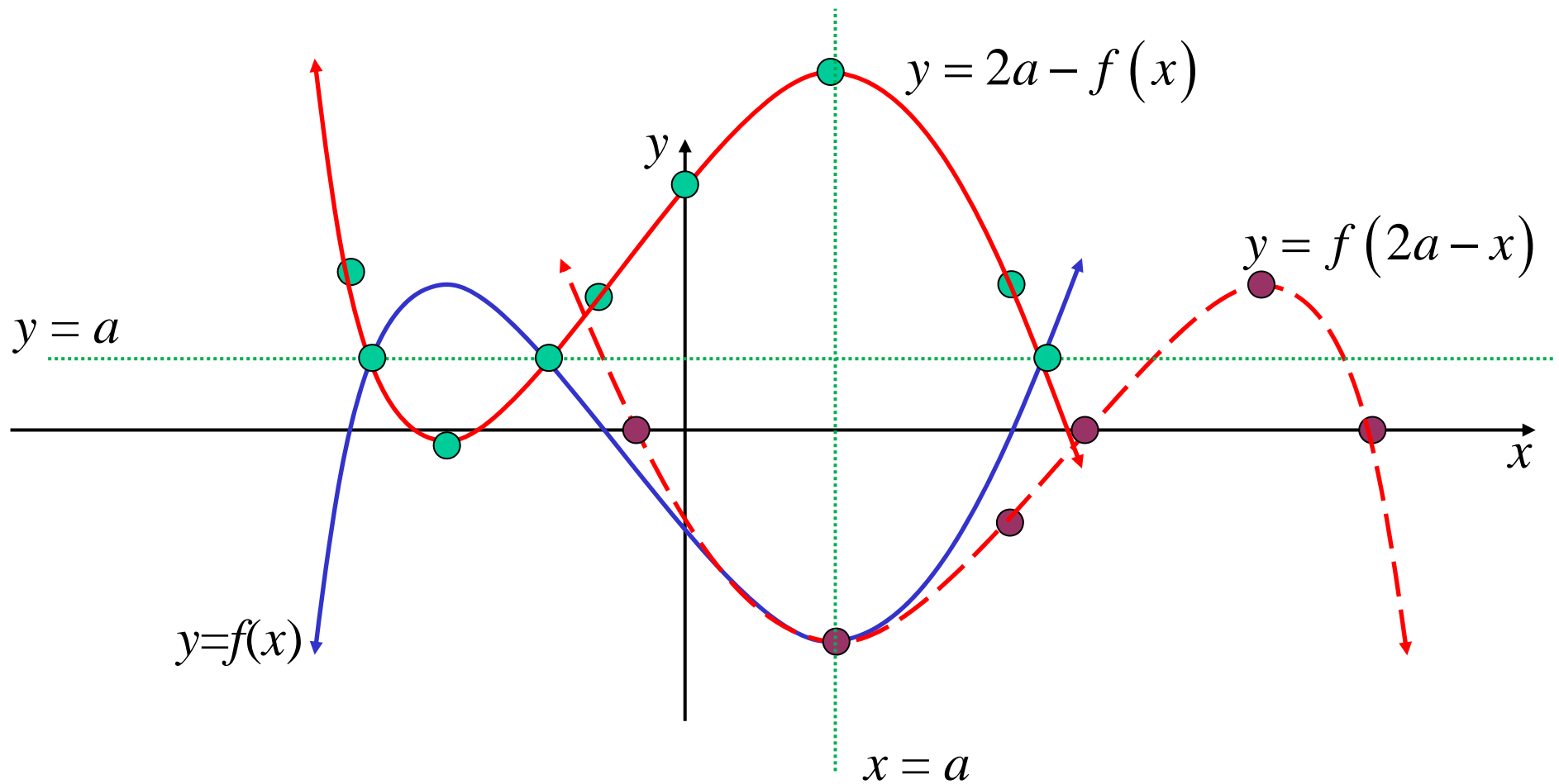
3. Reflecting Curves

- $y = -f(x)$ (reflect $f(x)$ in the x axis)
- $y = f(-x)$ (reflect $f(x)$ in the y axis)



• $y = f(2a - x)$ (reflect $f(x)$ in the line $x = a$)
(replace x with $2a - x$)

• $y = 2a - f(x)$ (reflect $f(x)$ in the line $y = a$)
(replace y with $2a - y$)



***“Cambridge”*: Exercise 8A; 1, 2a, 4, 5, 8, 9**