p 028, q5

5. Use words and mapping notation to describe how the graph of each function can be found from the graph of the function $y = f(x)$.

a) $y = 4f(x)$

b) $y = f(3x)$

c) $y = -f(x)$

d) $y = f(-x)$

All answers are based on the general formula

$$y = af(bx)$$

a: vertical stretch by a factor of a and/or vertical reflection into the x-axis

b: horizontal stretch by a factor of $\frac{1}{b}$ and/or horizontal reflection into the y-axis

a) $y = 4f(x)$ is a vertical stretch by a factor of 4

the mapping is $(x, y) \to (x, 4 \cdot y)$

b) $y = f(3x)$ is a horizontal stretch by a factor of $\frac{1}{3}$

mapping: $(x, y) \to (\frac{1}{3} \cdot x, y)$

c) $y = -f(x)$ is a vertical reflection into the x-axis

mapping: $(x, y) \to (x, -y)$

d) $y = f(-x)$ is a horizontal reflection into the y-axis

mapping $(x, y) \to (-x, y)$.