Guide to:
Transforming graphs y=f(x)

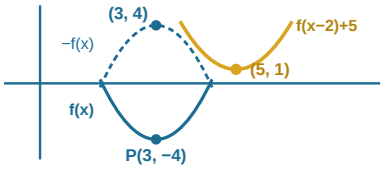
maths Links

Explanation:

Changes **outside** the bracket affect the **y-coordinates** as expected, whereas changes **inside** the bracket affect the **x-coordinates** in the opposite direction:

- **y = f(x) + a** translates by vector $\begin{pmatrix}0\\a\end{pmatrix}$ (up by a); **y = f(x + a)** translates by vector $\begin{pmatrix}-a\\0\end{pmatrix}$ (left by a).
- **y = −f(x)** reflects in the **x-axis** (y changes sign); **y = f(−x)** reflects in the **y-axis** (x changes sign).

Example 1: The curve y = f(x) has a turning point at P(3, −4). Find the coordinates of the turning point on: (a) y = f(x − 2) + 5 (b) y = −f(x).



Solution:

(a) Inside (x − 2) shifts **right by 2**: x = 3 + 2 = 5
Outside (+ 5) shifts **up by 5**: y = −4 + 5 = 1 ⇒ **(5, 1)**
(b) y = −f(x) reflects in the x-axis (multiply y by −1):
Answer: (a) (5, 1) (b) (3, 4)

Example 2: Given f(x) = x^2 − 4x, find the equation of the curve after a reflection in the y-axis followed by a translation of $\begin{pmatrix}0\\-3\end{pmatrix}$.

Solution:

Reflection in y-axis replaces x with −x:
f(−x) = $(-x)^2$ − 4(−x) = **x^2 + 4x**
Translation by $\begin{pmatrix}0\\-3\end{pmatrix}$ subtracts 3 from the function:
Answer: y = x^2 + 4x − 3

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ken@mathslinks.co.uk