

Transformations of Functions Review

Answer key Final answers only. Try first, then check.

CORE SKILLS

- K1**
- a) $(-2, 7), (0, 3), (1, 4), (4, 6)$
 - b) $(-5, 3), (-3, -1), (-2, 0), (1, 2)$
 - c) $(0, -2), (2, -6), (3, -5), (6, -3)$
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- K2**
- a) $y = -\sqrt{x+4} + 1; R = (-\infty, 1]$
 - b) $y = \sqrt{4-x} - 1; D = (-\infty, 4]$
 - c) $y = -f(x): (-3, 0); y = f(-x): (0, 1)$
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- K3**
- a) $(-4, 0), (-2, 4), (0, 2), (4, -6)$
 - b) $(-2, 0), (-1, 2), (0, 1), (2, -3)$
 - c) $y = 2f(x): (-4, 0)$ and $(1, 0); y = f(2x): (0, 1)$
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- K4**
- a) $(x, y) \rightarrow \left(\frac{x}{3} + 4, -2y + 5\right)$
 - b) $(3, 1)$
 - c) $D = [-5, 1], R = [-9, 7]$
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- K5**
- a) Vertical compression by a factor of $\frac{1}{2}$; horizontal compression by a factor of $\frac{1}{3}$ and reflection in the y -axis; translation 3 units right and 2 units down
 - b) $y = \frac{1}{2}(x+1)^2 - 3$
 - c) $x = -4$ and $y = 1$; image $(-3, -1)$

REAL WORLD

- A1**
- a) $g(t) = h(t - 1.5) = -5(t - 3.5)^2 + 20$
 - b) Priya's: top at 2 s, lands at 4 s. Friend's: top at 3.5 s, lands at 5.5 s (both reach 20 m).
 - c) $D = [1.5, 5.5]$. At $t = 1$ the ball has not been kicked yet: it is resting on the ground. $t = 1$ is outside the domain, so -11.25 m means nothing.
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- A2**
- a) $H(t) = h\left(\frac{4}{3}t\right)$; at $t = 15$ s
 - b) $W(t) = 1.5h(t); R = [3, 27]$ (metres)
 - c) Only the faster ride: a horizontal compression keeps every height, so its lowest point stays at 2 m. On the bigger wheel the lowest seat is at 3 m, 1 m above the platform.
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- A3**
- a) $D(h) = d(h + 45) = 3.57\sqrt{h + 45}$; a vertical stretch by a factor of 3.57 and a translation 45 units left
 - b) $D = [0, 36]$ (metres), $R \approx [23.9, 32.1]$ (kilometres)
 - c) $h \approx -13.6$: 13.6 m below the cliff top, outside the domain. Every visitor already sees at least 23.9 km, so no place on the cliff or tower gives 20 km.

THINK IT THROUGH

- T1**
- a) Student's: $\left(\frac{2}{3}, 0\right)$; required: $(2, 0)$
 - b) $y = \sqrt{3(x-2)} = \sqrt{3x-6}$
 - c) Translate 2 units right, then compress horizontally by a factor of $\frac{1}{3}$ (equivalently: compress by $\frac{1}{3}$, then translate $\frac{2}{3}$ of a unit right)
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- T2**
- a) $-f(-x) = -(x+1)^2$; e.g. $(1, 0)$ is on $y = f(x)$, but $-f(-1) = -4$
 - b) Odd functions, where $f(-x) = -f(x)$ for every x ; e.g. $y = x^3$ or $y = \frac{1}{x}$
 - c) $g(-1) = 2, -g(1) = 0$: not odd. $g(1) = 0 \neq g(-1)$: not even. Neither.

BOSS LEVEL

- Boss**
- a) $y = f(x + 4)$: a translation 4 units left
 - b) $(1, 6)$
 - c) Every point with $x = 2$: the pair is a reflection in the line $x = 2$.
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