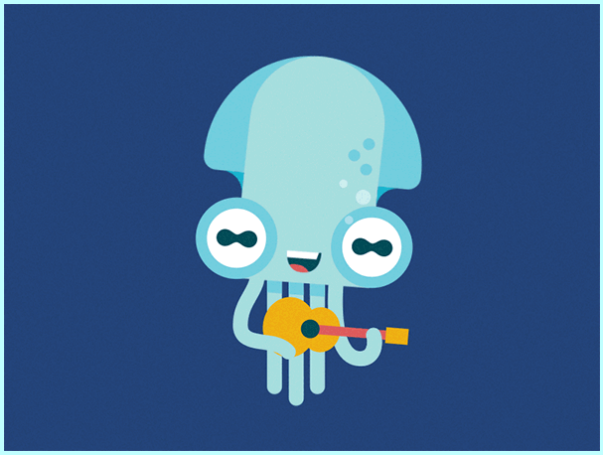
# Inverse Functions



1.) Find $f(g(x))$ and $g(f(x))$.

$f(x) = 2x + 3$ $\quad g(x) = \frac{x-3}{2}$

$f(g(x)) = 2(\quad) + 3$

$= 2\left(\frac{x-3}{2}\right) + 3$

$= x - 3 + 3$

$= x$

$g(f(x)) = \frac{(\quad) - 3}{2}$

$= \frac{(2x+3)-3}{2}$

$= \frac{2x}{2}$

$= x$

Functions are inverses of each other when...

$$f(g(x)) = x = g(f(x))$$

# Determining Whether the Inverse is a Function

**Horizontal Line Test**: The inverse of a relation is a function if and only if each horizontal line intersects the graph of the original relation in at most one point.

**Find the inverse of the function, then determine whether the inverse is a function.**

2.) $k(x) = 3x - 5$

① $y = 3x - 5$ ① *Rewrite equation as y =.

② $x = 3y - 5$ ② *Switch x & y.

$+5 \quad +5$

③ *Solve for y.

③ $x + 5 = 3y$

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

yes ✓

$\frac{x+5}{3} = k^{-1}(x)$

3.) ~~$k(x)$~~ $= \frac{x}{x-5}$ Is the inverse a function?

$y = \frac{x}{x-5}$

$x = \frac{y}{y-5}$ → $x(y-5) = y$

$xy - 5x = y$

$+5x \quad +5x$

$xy = y + 5x$

$-y \quad -y$

$xy - y = 5x$

$\frac{y(x-1)}{x-1} = \frac{5x}{x-1}$

$y = \frac{5x}{x-1}$

$h^{-1}(x) = \frac{5x}{x-1}$ ✓ yes

4.) $d(x) = -\sqrt[3]{x-8}+3$ Is the inverse a function?

$y = -\sqrt[3]{x-8}+3$

$x = -\sqrt[3]{y-8}+3$

$x-3 = -\sqrt[3]{y-8}$

$-1 \quad -1$

$-1$

$(-x+3) = \sqrt[3]{y-8}$ → $(-x+3)^3 = \left(\sqrt[3]{y-8}\right)^3$

$(-x+3)^3 = y-8$

$(-x+3)^3 + 8 = d^{-1}(x)$

5.) $g(x) = \frac{3}{2}x - 6$ Is the inverse a function?

6.) Verify $f(x)=2x-4$ *and* $f^{-1}(x)=\frac{1}{2}x+2$ are inverses of each other.

$=2(\quad)-4$

$=2\left(\frac{1}{2}x+2\right)-4$

$=1x+4-4$

$=x$ ✓

$=\frac{1}{2}(\quad)+2$

$=\frac{1}{2}(2x-4)+2$

$=x-2+2$

$=x$ ✓

7.) Verify $f(x)=-3x+6$ *and* $f^{-1}(x)=-\frac{1}{3}x+2$ are inverses of each other.

# Homework

pg. 126: 9-12, 13-21 odd, 27-31 odd, 34, 43, 44

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