WRH 9 Solutions

4.4: 3, 10, 14, 16, 17, 39, 51, 65

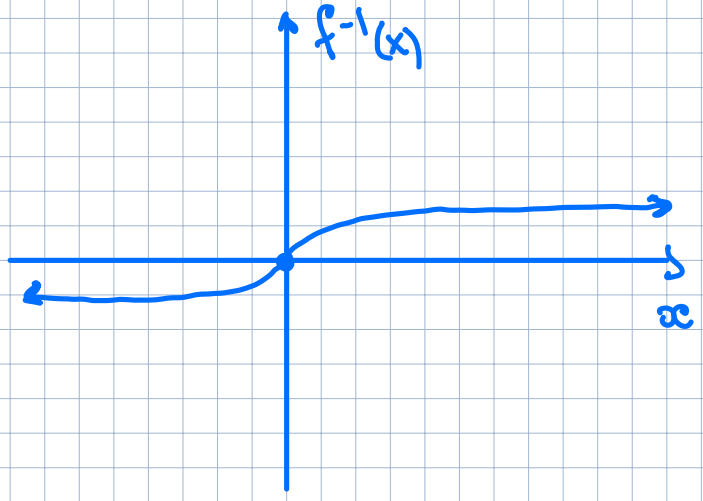
5.1: 1, 13, 24, 37, 43, 56, 64, 68

4.4

3. $y = x^3$

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

$f^{-1}(x) = \sqrt[3]{x}$



$\text{dom}(f^{-1}) = \mathbb{R}$

$\text{Ran}(f^{-1}) = \mathbb{R}$

10. $T = \{(4,2), (3,-1), (-2,-1), (2,4)\}$

$T^{-1} = \{(2,4), (-1,3), (-1,-2), (4,2)\}$

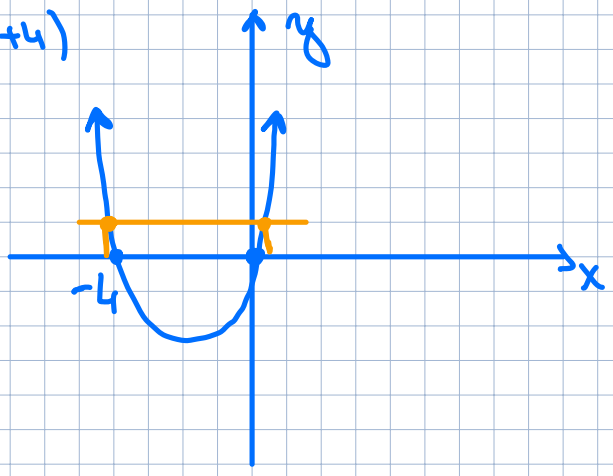
$\text{dom}(T^{-1}) = \{2, -1, 4\}$

$\text{Ran}(T^{-1}) = \{4, 3, -2, 2\}$

14. $y = x^2 + 4x = x(x+4)$

f is not one-to-one function

$f(-5) = f(1) = 5.$



16. $y = \frac{-3x-3}{2}$

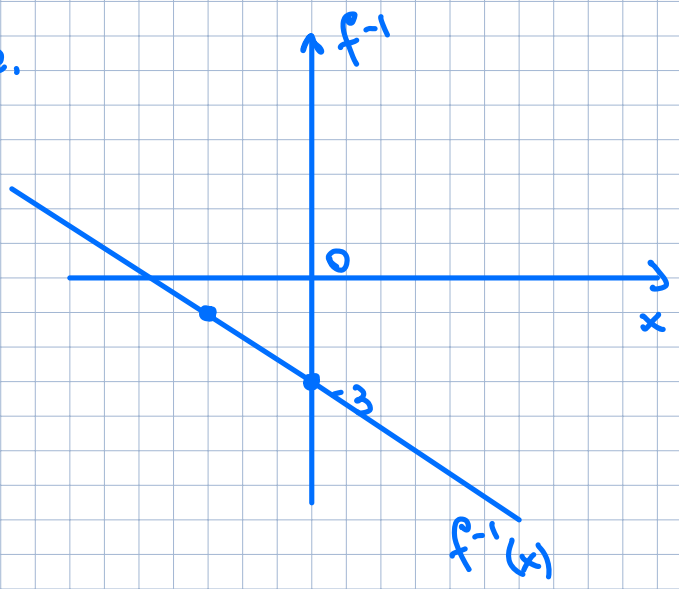
y is one-to-one.

$2y = -3x - 3$

$2y + 3 = -3x$

$x = -\frac{2y+3}{3}$

$\boxed{f^{-1}(x) = -\frac{2}{3}x - 3}$



17. $f(x) = x^2 + 1$

$f(x)$ is not one-to-one $\Rightarrow$ f does not have inverse function.

$\boxed{\text{For } x \in [0, \infty)}$ f has inverse.

39. $J(x) = \frac{2}{1-3x}$

$(1-3x)\,J(x) = 2$

$(1-3x) = \frac{2}{J(x)}$

$-3x = \frac{2}{J(x)} - 1$

$x = \frac{2}{-3J} + \frac{1}{3}$

$J^{-1}(x) = \frac{2}{-3x} + \frac{1}{3} = \boxed{\frac{-2+x}{3x}}$

51. $f(x) = \sqrt[3]{x+2} - 1$

$f^{-1}(x) = (x+1)^3 - 2$

$f(f^{-1}(x)) = f((x+1)^3 - 2) = \sqrt[3]{(x+1)^3 - 2 + 2} - 1 =$

$= x$

$f^{-1}(f(x)) = f^{-1}(\sqrt[3]{x+2} - 1) = (\sqrt[3]{x+2} - 1 + 1)^3 - 2 =$

$= x$

65. $f(x) = \sqrt[3]{x+1}$

$y = \sqrt[3]{x+1}$

$y^3 = x + 1 \Rightarrow x = y^3 - 1 \Rightarrow f^{-1}(x) = x^3 - 1$

(d)

5.1

1. $9x^2 - 4x = 2x^3 + 15$

$x = -1$

$9(-1)^2 - 4(-1) = 2(-1)^3 + 15$

$9 + 4 = -2 + 15$

$13 = 13$ ✓

13. $4x^2 + 32x + (8+i)x^3 = -8$

$x = 2i$

$4 \cdot (2i)^2 + 32(2i) + (8+i)(2i)^3 = -8$

$4 \cdot (-4) + 64i + (8+i) \cdot (-8i) = -8$

$-16 + \cancel{64i} - \cancel{64i} + 8 = -8$

$-8 = -8$ ✓

24. $x^3 - x^2 - 6x = 0$

$x(x^2 - x - 6) = 0$

$x = 0$ or $x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$x = 3$ or $x = -2$

Answer: $\{0, -2, 3\}$

37. $j(x) = 4x^7 + 5x^5 + 12$

$\deg(j) = 7$

$a_7 = 4$

As $x \to +\infty$: $j(x) \to +\infty$

As $x \to -\infty$: $j(x) \to -\infty$

43. $g(x) = (3-x)(x+2)(x+4)$

As $x \to +\infty$: $g(x) \to -\infty$

As $x \to -\infty$: $g(x) \to +\infty$

X-intercept: $g(x) = 0$

$(3-x)(x+2)(x+4) = 0$

$x = 3$ or $x = -2$ or $x = -4$

$(3,0)$, $(-2,0)$ or $(-4,0)$

Y-intercept: $x = 0$

$y = 24$

$(0, 24)$

56.

$f(x) = (x-1)(x+2)(3-x)$

As $x \to +\infty$: $f(x) \to -\infty$

As $x \to -\infty$: $f(x) \to +\infty$

$x = 0$: $f = -6$ $(0, -6)$

$y = 0$: $x = 1$ or $x = -2$ or $x = 3$

$(1, 0)$, $(-2, 0)$ or $(3, 0)$

(b)

64. $S(x) = x^3 + 5x^2 + 4x$

As $x \to +\infty$: $S(x) \to +\infty$

As $x \to -\infty$: $S(x) \to -\infty$

$S(x) = x(x^2 + 5x + 4)$

$S(x) = 0 \iff x = 0$ or $x^2 + 5x + 4 = 0$

$(x+4)(x+1) = 0$

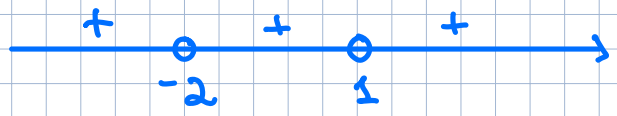
$x = -4$ or $x = -1$

$x = 0 \iff S(x) = 0$

(c)

68. $(x+2)^2(x-1)^2 > 0$

$(x+2)(x+2)(x-1)(x-1) > 0$



$(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$