Solutions to Selected Exercises: Homework Assignment #2

Assignment. Section 1.4:

Part 1: Functions: evaluation, composition, domain (pages 39–40): Exercises 1, 2abefg.

Part 2: Graphing functions using software (like Sage) (pages 40–43): Exercises 5, 8, 9efghi.

Section 1.5:

Part 1: Linear functions and graphs (page 52): Exercises 4, 5(b).

Part 2: Linear models (pages 53–54): Exercises 6, 7, 8.

Section 1.4:

Exercise 1.

$$c(5,-3) = 17, \quad s(17) = 289, \quad c(a,b) = 17, \quad j(u^2+1) = u^2+1,$$
$$j(c(3,-5)) = 17, \quad \ell(1.1) = 1.9, \quad r(1/17) = 17, \quad Q(0) = -\frac{1}{6},$$
$$Q(2) \text{ is undefined}, \quad Q(3/7) = -\frac{13}{33}, \quad D(5,-3) = 8, \quad D(-3,5) = -8,$$
$$H(1) = 3, \quad H(7) = 22, \quad \ell(4) = -1, \quad H(H(H(-3))) = 2,$$
$$r(Q(3)) = \frac{3}{7}, \quad Q(r(3)) = -\frac{1}{3}, \quad T(3,7) = \frac{4}{3}, \quad T(s(2), j(3)) = \frac{31}{12},$$
$$r(s(-4)) = \frac{1}{16}, \quad r(r(r(r(r(u))))) = \frac{1}{u}, \quad \ell(\text{whatever}) = 3 - \text{whatever},$$
$$D(\text{mellow}, \text{yellow}) = \text{mellow} - \text{yellow}.$$

Exercise 2. (a) True. We have $r(r(x)) = 1/(1/x) = x = j(x)$.

(b) True. We have $c(\pi, 965.32) = 17 = j(17)$.

(e) False. In general, $(a+b)^2 \neq a^2 + b^2$. For example, $(7+2)^2 = 9^2 = 81$, but $7^2 + 2^2 = 49 + 4 = 53$.

(f) True. We have $s(r(x)) = s(1/x) = (1/x)^2 = 1^2/x^2 = 1/x^2$, and $r(s(x)) = r(x^2) = 1/x^2$.

(g) False. We have $s(\ell(x)) = s(3-x) = (3-x)^2$, while $\ell(s(x)) = \ell(x^2) = 3 - x^2$. And in general $(3-x)^2 \neq 3 - x^2$, e.g. $(3-5)^2 = (-2)^2 = 4$ while $3 - 5^2 = 3 - 25 = -22$.

Exercise 8. (a) The y-intercept is when $x = 0$; here our y-intercept is $y = f(0) = 1-2\times0^2 = 1$.

The x-intercepts are when $y = f(x) = 0$; that is, $1 - 2x^2 = 0$. Solving gives $x^2 = 1/2$, or $x = \pm1/\sqrt{2}$.

(b) To four places of accuracy, $x = 0.0.7071\ldots$.

Exercise 9. (f) The x-intercepts of $f(x)$ appear to be about 3.14 units apart. The x-intercepts of $g(x)$ appear to be about 1.57 units apart – half as far as part as those of $f(x)$.

(g) $g(x)$ seems to repeat itself about every 3.14... units; $f(x)$ appears to repeat itself about every 6.28... units.

(h) It appears that the graph of $g(x) = \cos(2x)$ is just the graph of $f(x) = \cos(x)$, but compressed horizontally by a factor of 2.

(i) $h(x) = 2\cos(2x)$.

Section 1.5:

Exercise 4. (b) $y = -3x + 16$.

Exercise 5. (b). $x = -2$. $x = 2$. $x = -1/2$. $x = -487/2$.

Exercise 6. The formula is $T = 0.05P$. The tax on a television set that costs \$289.00 is $T = 0.05(\$289.00) = \$14.45$. The tax on a toaster that costs \$37.50 is $T = 0.05(\$37.50) = \$1.875$ (or, rounded up to the nearest penny, \$1.88).

Exercise 7. Suppose $W = 213 - 17Z$. If Z changes from 3 to 7, then W changes from $213 - 17(3) = 162$ to $213 - 17(7) = 94$. That is, W changes by -68 (or: W decreases by 68). If Z changes from 3 to 3.4, then W changes by -6.8. If Z changes from 3 to 3.02, then W changes by -0.34. Let ΔZ denote a change in Z, and ΔW the change thereby produced in W. Then $\Delta W = -17\Delta Z$. That is, any change in Z produces -17 times as large a change in W.