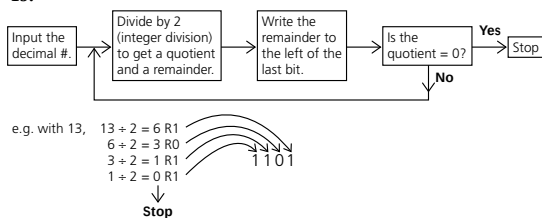


Practise, Apply, Solve 3.4, page 255

- relationship and inverse are both functions: each element of the domain corresponds to a unique value of the range
 - relationship is a function: passes vertical line test; inverse not a function: 3 maps onto more than one value
 - relationship not a function: 1 maps onto more than one value; inverse is a function: each x-coordinate corresponds to a unique y-coordinate.
- $4 \rightarrow 1, 4 \rightarrow 2, 5 \rightarrow 1, 6 \rightarrow 3$; not a function: 4 maps onto 1 and 2
 - $4 \rightarrow 1, 4 \rightarrow 2, 4 \rightarrow 3$; not a function: 4 maps onto 1, 2, and 3
 - $4 \rightarrow 2, 5 \rightarrow 2, 6 \rightarrow 2$; inverse is a function: each element of the domain corresponds to one value in the range.
- first differences are all -1
 - first differences are all -2
 - $(-1, 7), (0, 5), (1, 3), (2, 1), (3, -1), (4, -3), (5, -5)$
 - $\frac{-1}{2}$ (e) -2
 - $f(x) = -0.5x + 2.5, x \in \{-5, -3, -1, 1, 3, 5, 7\}$
 - $f^{-1}(x) = -2x + 5, \{x \mid -1 \leq x \leq 5, x \in \mathbf{I}\}$
 - The slope of the line through the points in f is the reciprocal of the slope of the line through the points in f^{-1} . Normally, the first differences would also be reciprocals of each other, but the x-coordinates in f increase by 2 each time.
- $(5, 0), (3, -1), (2, -2), (2, -3), (3, -4), (5, -5)$
 - $(-2, 6), (-1, 5), (0, 4), (1, 3), (2, 2), (3, 1), (4, 0), (5, -1), (6, -2)$
 - $(5, 5), (2, 2), (0, 1), (-1, 0), (-1, -1), (0, -2), (2, -3), (5, -4)$
 - $(-2, 2), (-1, 1), (0, 0), (1, -1), (2, -2), (3, -3), (4, -4), (5, -5)$
 - $(-1, -2), (-1, -1), (-1, 0), (0, 1), (1, 2), (2, 2), (3, 2), (4, 3), (5, 4), (5, 5), (5, 6)$
 - straight line from $(0, 6)$ to $(5, -5)$
 - connected points: $(1, 6)$ to $(-1, 4)$ to $(-1, 1)$ to $(5, -2)$ to $(5, -5)$
 - connected points: $(4, 3)$ to $(3, 0.5)$ to $(2.5, 1.5)$ to $(2, -1)$ to $(1.5, -0.5)$ to $(1, -3)$ to $(-1, -1)$
- no points common (b) all points common
 - $(-1, -1)$ and $(2, 2)$
 - $(-2, 2), (-1, 1), (0, 0), (1, -1),$ and $(2, -2)$
 - $(2, -1), (-1, 2),$ and $(\frac{1}{3}, 0)$ (f) $(\frac{15}{8}, \frac{15}{8})$
 - no points common (h) $(-1, -1)$
- $(1, 6), (2, 5), (4, 3), (5, 2), (4, 0), (3, -2)$
 - $D = \{1, 2, 3, 4, 5\}, R = \{-2, 0, 2, 3, 5, 6\}$
 - $4, -2, 5, 5, 2, 0$ or 3
 - not a function: 4 maps onto 0 and 3.
 - $(1, 6)$; 1 is the x-coordinate of that point; $f^{-1}(1)$ is y-coordinate of that point.
- -2 (b) 0 (c) 13 (d) 5 (e) $\frac{t+2}{3}$
 - $\frac{2}{3}$ (g) $\frac{7}{3}$ (h) $\frac{a+2}{3}$ (i) $\frac{x}{3}$ (j) a
 - $t+2$ (l) t (m) $\frac{1}{3}$ (n) $\frac{1}{3}$ (o) $\frac{1}{3}$
 - 3 (q) $\frac{1}{3}$
- -6 (b) 2 (c) 14 (d) $\frac{3}{2}x + 5$
 - $\frac{2}{3}(x-5)$ (f) -6 (g) 9 (h) $\frac{3}{2}a + 5$
 - $\frac{3}{2}(a+1) + 5$ (j) $\frac{3}{2}$ (k) t
 - $\frac{3}{2}$ (m) $\frac{2}{3}$
- $\frac{3}{2}$ if $a \neq b$; undefined if $a = b$
- straight line through $(5, -1)$ and $(-4, 5)$; f^{-1} : straight line through $(5, -4)$ and $(-1, 5)$
 - $\frac{-2}{3}x + \frac{7}{3}$ (b) $\frac{-3}{2}x + \frac{7}{2}$ (c) -4
 - $(-4, 5)$ (e) $(5, -4)$ (g) -1
 - $(5, -1)$ (i) $(-1, 5)$ (k) 1.4
 - $(1.4, 1.4)$ (m) $(1.4, 1.4)$
- Multiply by 10, then divide by 4.
 - Example: convert a person's height from feet and inches to centimetres
 - $\frac{4x}{10}$ (d) $\frac{10x}{4}$ (e) $f(15)$ (f) $f^{-1}(66)$
- -2 (b) -2 (c) $-x + 5$
 - g : straight line through $(0, 5)$ and $(5, 0)$; g^{-1} : straight line through $(5, 0)$ and $(0, 5)$ (They are the same.)
 - g and g^{-1} represent the same line because of symmetry in the line $y = x$
- f : straight line through $(1.5, 0)$ and $(0, 3)$; f^{-1} : straight line through $(0, 1.5)$ and $(3, 0)$
 - $\frac{3}{2}$ (b) 3 (c) 1 (d) 1 (e) 1
 - For $f(x) = 0$, y-coordinate = 0, so x-intercept = $\frac{3}{2}$ and y-intercept of f^{-1} is $\frac{3}{2}$ (b) For $f^{-1}(x) = 0$, y-coordinate = 0, so x-intercept = 3 and y-intercept of $f = 3$ (c) For $f(x) = x$, y-coordinate = x-coordinate, so $(1, 1)$ is a point on f where x- and y-coordinates are equal, a point on graph of f^{-1} where x- and y-coordinates are equal, and the intersection point of each graph with graph of $y = x$. (d) For $f^{-1}(x)$, y-coordinate = x-coordinate on f^{-1} . (e) For $f^{-1}(x) = f(x)$, both y-coordinates are equal; so $x = 1$ at the point of intersection of f and f^{-1} .
- Multiply sales by 0.05, then add \$100.
 - $20(s - 100)$
 - Subtract \$100 from weekly pay, then multiply by 20.
 - employee could check that paycheck is correct
 - $D = \{s \mid 0 \leq s \leq 20\,000, s \in \mathbf{R}\}$,
 $R = \{p \mid 100 \leq p \leq 1100, p \in \mathbf{R}\}$
- series of vertical bars (graph in question rotated 90° counterclockwise)
 - not a function: price does not uniquely determine the mass of the letter
 - $50 \text{ g} < \text{mass} < 100 \text{ g}$
- $y = 0.380x + 0.490$
- horizontal line from $(0, 322)$ to $(1000, 322)$, then slope upward to right through $(1800, 362)$
 - $f(s) = 272 + 0.05s$
 - vertical line from $(322, 0)$ to $(322, 1000)$, then slope upward through $(362, 1800)$
 - If $s > 322$, $f^{-1}(s) = 20s - 5440$; if $s = 322$, then $f^{-1}(s)$ can be any value between 0 and 1000.
 - $f^{-1}(420) = 20(420) - 5440 = 2960$
- $f(p) = -3040p + 14\,700$
 - $(1000, 4.39), (2500, 4.070), (700, 4.65), (800, 4.59), (2700, 3.94)$
 - $f^{-1}(m) = -0.000\,314m + 4.81$
 - $f^{-1}(m) = -0.000\,329m + 4.84$
 - They are similar. The process for determining the line of best fit causes slight differences.
 - 260 kg (h) none (i) \$3.55
- A postal code must be a function because each address in Canada must have a reliable, consistent postal code. One address cannot have more than one postal code.

- (b) The inverse converts the postal codes into address. Several neighbouring houses may have the same postal code, so one postal code produces several possible addresses. It is not a function.

19.



Divide by 2, giving a quotient and a remainder. Write the remainder as the next bit (moving left). Repeat using the quotient. Continue until the number is 0 after the remainder is subtracted.

20. (a) 5 667 821 743 (b) 792 543 872
 (c) $f(x) = 9 - x, \{x \mid x \leq 9, x \in \mathbf{W}\}$
 (d) $f^{-1}(x) = 9 - x, \{x \mid x \leq 9, x \in \mathbf{W}\}$
 (e) same graph: (0, 9), (1, 8), (2, 7), (3, 6), (4, 5), (5, 4), (6, 3), (7, 2), (8, 1), (9, 0)

21. (a) 21 525
 (b) function: each word can only be coded in one way.
 (c) BOTTOM or BOB_TOM or many other combinations that may not be English words.
 (d) inverse is not a function: knowing the encoded digits does not uniquely determine the message because we cannot be sure how the letters are grouped.
22. (a) soft drink received
 (b) combination of coins and a button selection
 (c) set of all the different drinks the machine produces
 (d) set of all possible combinations of coins and button selections that would yield a drink from the machine
 (e) no: type of coins entered does not uniquely determine the size and type of drink