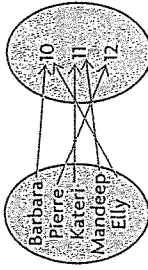
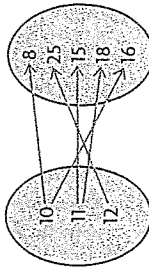


Answers

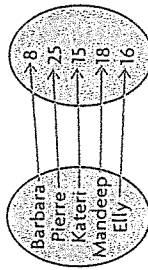
- Function; each x -value has only one y -value
 - Not a function; for $x = 1, y = -3$ and 0
 - Not a function; for $x = 0, y = 4$ and 1
 - Function; each x -value has only one y -value
- Not a function
 - Not a function
 - Function
 - Not a function
 - Not a function
 - Not a function
- For $y = x^2 - 5x$, each x -value gives a single y -value. For $x = j^2 - 5j$, each x -value gives a quadratic equation in y , which may have two solutions.
- {(Barbara, 10), (Pierre, 12), (Kateri, 11), (Mandeep, 11), (Elly, 10)}



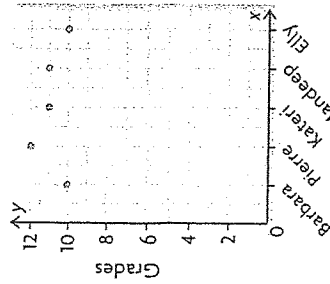
{(10, 8), (12, 25), (11, 15), (11, 18), (10, 16)}



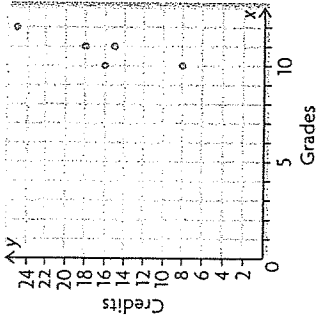
{(Barbara, 8), (Pierre, 25), (Kateri, 15), (Mandeep, 18), (Elly, 16)}



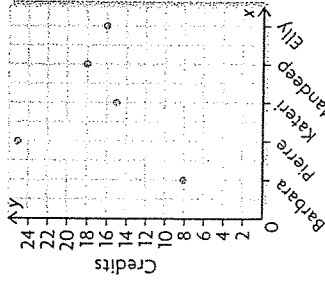
- students; grades: domain = {Barbara, Pierre, Kateri, Mandeep, Elly}, range = {10, 11, 12} grades, credits: domain = {10, 11, 12}, range = {8, 15, 16, 18, 25} students, credits: domain = {Barbara, Pierre, Kateri, Mandeep, Elly}, range = {8, 15, 16, 18, 25}
 - Only grades-credits relation is not a function; it has repeated range values for single domain values.



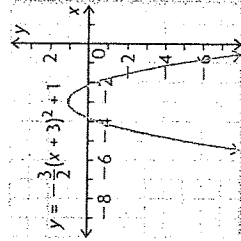
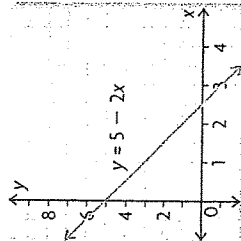
grades, credits:



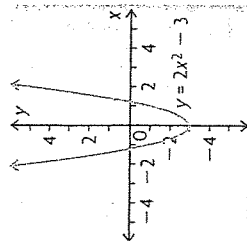
students, credits:



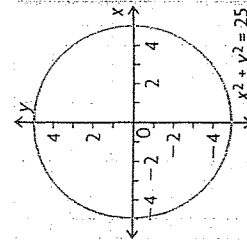
- horizontal line; function (passes vertical-line test).
 - vertical line; not a function (fails vertical-line test)
- Linear, function
 - Quadratic, function
 - Circle, not a function



b) Quadratic, function



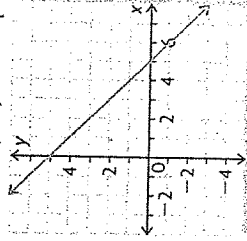
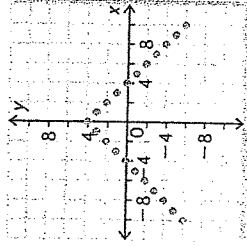
d) Circle, not a function



- $1.25; 2.75$ ii) $\pm 2; 0$ iii) $2; -2$ iv) $0; \pm\sqrt{2}$
 - Functions: (i), (iii)
 - Graph relation and apply vertical-line test, or solve equation for y and check for multiple values
- Functions: (a), (b), (d)
- Not a function; for example, when $x = 6, y = 2$ or -2 ; graph fails vertical-line test
- Functions: (a), (b)
- domain = $\{x \in \mathbb{R} \mid x \geq 0\}$, range = $\{y \in \mathbb{R} \mid y \geq 44\}$
- Distance cannot be negative, cost cannot be lower than daily rental charge.

c) Yes, it passes the vertical line test.

13. a) Answers may vary; for example: b) Answers may vary; for example:



14. Answers may vary; for example:

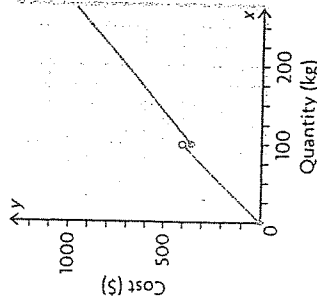
Definition:
A relation with only one y -value for each x -value

Examples:
 $3x + y = 2$
 $y = -2x^2 + 7$

Characteristics:
A vertical line crosses the graph in at most one place

Non-examples:
 $x^2 + y^2 = 16$
 $y = \pm\sqrt{x} - 7$

- Each order quantity determines a single cost.
 - domain = $\{x \in \mathbb{R} \mid x \geq 0\}$, range = $\{y \in \mathbb{R} \mid y \geq 0\}$



Answers may vary. For example, the company currently charges more for an order of 100 kg (\$350) than for an order of 99 kg (\$396). A better system would be for the company to charge \$50 plus \$3.50 per kilogram for orders of 100 kg or more. This would make the prices strictly increasing as the weight of the order increases.

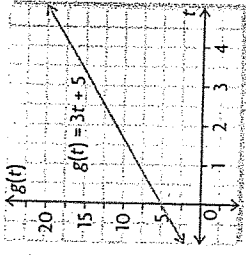
Relations and Functions

Students

Answers

1. a) -4 c) 14 e) $2 - 3x$
 b) 2 d) $\frac{1}{2}$ f) $2 - 9b$
2. a) 2 b) 4 c) -5 d) -3 or -4
3. a) $f(x) = 1200 - 3x$
 b) 840 mL c) 3:10 pm
4. a) 8, 0, -0.75 b) -5, -25, -2.5
5. a) $-\frac{1}{6}$ b) undefined c) $\frac{1}{3}$ d) $2\frac{2}{3}$
6. a) domain = $\{-2, 0, 2, 3, 5, 7\}$, range = $\{1, 2, 3, 4, 5\}$
 b) i) 4 ii) 2 iii) 5 iv) -2
7. a) $2x - 5$ b) $2b - 3$ c) $6c - 7$ d) $-10x - 1$

t	g(t)
0	5
1	8
2	11
3	14
4	17
5	20



8. a) i) 5 ii) 14 iii) 3 iv) 3 v) 3 vi) 3
9. a)

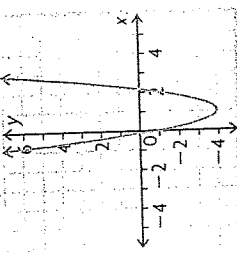
s	f(s)
0	9
1	4
2	1
3	0

 b) i) 9 ii) 4 iii) 1 iv) 0 v) 2 vi) 2
 c) They are the same; they represent the second differences, which are constant for a quadratic function.

10. a) 49
 b) The y-coordinate of the point on the graph with x-coordinate -2
 c) domain = $\{x \in \mathbb{R}\}$, range = $\{y \in \mathbb{R} \mid y \geq -1\}$
 d) It passes the vertical-line test.

11. a) 2 b) 0.4 c) 0.8 d) $\frac{17}{25}$
 12. a) $f(x) = 0.15x + 50$ b) \$120.80 c) 200 km
 13. a) $f(x) = (24 - 3x)x$ b) 45, -195, -60 c) 48
 14. $f(x) = 0.0034x(281 - x)$

15. a) $f(x) = 3(x - 1)^2 - 4$



- b) The y-coordinate of the point on the graph with x-coordinate -1; start from -1 on x-axis, move up to curve, then across to y-axis
 c) i) 3 ii) 9 iii) $3x^2 - 4$
 16. a) 3, -5 b) 1, -3 c) -1
 17. a) $\frac{1}{4}$ b) $\frac{1}{3}$, -1

18. Answers may vary; for example; $f(x)$ is defined as equal to an expression involving x , for each x -value in the functions domain; the graph of $f(x)$ is the set of all points $(x, f(x))$ for which x is in the domain. Student examples will vary.
19. a) $f(x) = \frac{2}{3}x + 10$ b) $73\frac{1}{3}$, $126\frac{2}{3}$, $153\frac{1}{3}$, 180
 20. a) 8, 27, 64, 125, 216 b) cube of x or x^3

Function Notation