

Revision Exercise (Functions)

1. a)

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|--------------|----------------------|------------|--------------|
| (i) $x(x-1)$ | (iii) 1 | (v) $x-1$ | (vii) x |
| (ii) $2x-1$ | (iv) $\frac{x}{x-1}$ | (vi) $x-1$ | (viii) $x-2$ |

1. b)

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|----------------------------|---------------------------|---------------------|------------------------|
| (i) $4x^3 + x^2 + 12x + 3$ | (iii) $-x^2 + 4x - 2$ | (v) $4x^2 + 13$ | (vii) $16x + 5$ |
| (ii) $x^2 + 4x + 4$ | (iv) $\frac{4x+1}{x^2+3}$ | (vi) $(4x+1)^2 + 3$ | (viii) $(x^2+3)^2 + 3$ |

1. c)

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|-----------------------------|---------------------------|---------------------|--------------------------|
| (i) $-5x^3 + 5x^2 + 2x - 2$ | (iii) $-5x^2 - x + 3$ | (v) $3 - 5x^2$ | (vii) x |
| (ii) $5x^2 - x - 1$ | (iv) $\frac{1-x}{5x^2-2}$ | (vi) $5(1-x)^2 - 2$ | (viii) $5(5x^2-2)^2 - 2$ |

1. d)

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|---------------------|-------------------------|-----------------|------------------|
| (i) $3x^3 - 5x^2$ | (iii) $x^2 - 3x + 5$ | (v) $(3x-5)^2$ | (vii) x^4 |
| (ii) $x^2 + 3x - 5$ | (iv) $\frac{x^2}{3x-5}$ | (vi) $3x^2 - 5$ | (viii) $9x - 20$ |

1. e)

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|---|-------------------------------------|----------------------------------|-------------------------------------|
| (i) $\frac{1}{2}x^2 + 2x - \frac{5}{2}$ | (iii) $\frac{1}{2}x + \frac{11}{2}$ | (v) $\frac{1}{2}x + \frac{9}{2}$ | (vii) $x + 10$ |
| (ii) $\frac{3}{2}x + \frac{9}{2}$ | (iv) $\frac{2x+10}{x-1}$ | (vi) $\frac{1}{2}x + 2$ | (viii) $\frac{1}{4}x - \frac{3}{4}$ |

1. f)

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|----------------------------|-----------------------------|------------------------|-----------------|
| (i) $1 - \frac{7}{x}$ | (iii) $\frac{1}{x} - x + 7$ | (v) $\frac{1}{x-7}$ | (vii) x |
| (ii) $\frac{1}{x} + x - 7$ | (iv) $\frac{1}{x(x-7)}$ | (vi) $\frac{1}{x} - 7$ | (viii) $x - 14$ |

1. g)

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|--------------------------------------|---------------------------------------|-----------------------------|---------------------------|
| (i) $\frac{3x(x+1)}{(x+3)(x+4)}$ | (iii) $\frac{-2x^2-4x+4}{(x+3)(x+4)}$ | (v) $\frac{2(x+1)}{3(x+2)}$ | (vii) $\frac{x+2}{2x+5}$ |
| (ii) $\frac{4x^2+14x+4}{(x+3)(x+4)}$ | (iv) $\frac{x^2+5x+4}{3x(x+3)}$ | (vi) $\frac{3x+3}{5x+13}$ | (viii) $\frac{9x}{7x+16}$ |

1. h)

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|--------------------------|------------------------------|----------------------|---------------------|
| (i) $\sqrt{x}(2x+1)$ | (iii) $\sqrt{x} - 2x - 1$ | (v) $\sqrt{2x+1}$ | (vii) $\sqrt[4]{x}$ |
| (ii) $\sqrt{x} + 2x + 1$ | (iv) $\frac{\sqrt{x}}{2x+1}$ | (vi) $2\sqrt{x} + 1$ | (viii) $4x + 3$ |

2.

- a) $\{-4, -2, 0, 2, 4, 6\}$
- b) $\{-3, -2, -1, 0, 1, 2\}$

- c) $\{0, 1, 4, 9\}$
- d) $\{2, 4, 8, 16, 32\}$

- e) $\{\frac{2}{7}, \frac{1}{3}, \frac{2}{5}, \frac{1}{2}, \frac{2}{3}\}$
- f) $\{-1, -\frac{1}{8}, \frac{1}{8}, 1\}$

3.

- a) $\{y \geq 3, y \in \mathbb{N}\}$
- b) $\{y > 16, y \in \mathbb{R}\}$

- c) $\{y \geq 1, y \in \mathbb{R}\}$
- d) \mathbb{N}

- e) $\{-1 \leq y \leq 1, y \in \mathbb{R}\}$
- f) $\{1 \leq y \leq 3, y \in \mathbb{R}\}$

4.

- a) $\{0, 1, 2, 3\}$
- b) $\{-3, -2, -1, 0\}$

- c) $\{x \geq -2, x \in \mathbb{R}\}$
- d) $\{x \geq 3, x \in \mathbb{R}\}$

- e) $[0, \pi]$
- f) $[0, \pi]$

5.

- a) Surjective
- b) Not Surjective

- c) Surjective
- d) Not Surjective

- e) Not Surjective
- f) Surjective

6.

- a) Not a function
- b) Not a function

- c) Function
- d) Not a function

- e) Function
- f) Function

7.

- a) Bijective
- b) Bijective

- c) Not bijective
- d) Bijective

- e) Not bijective
- f) Bijective

8. a)

- (i) $12x + 4$
- (ii) $12x + 1$

- (iii) $\{16, 28, 40, 52, 64\}$
- (iv) $\{13, 25, 37, 49, 61\}$

8. b)

- (i) $2x + 1$
- (ii) $2x + 2$

- (iii) $\{-5, -3, -1, 1, 3, 5\}$
- (iv) $\{-4, -2, 0, 2, 4, 6\}$

8. c)

(i) $(x + 1)^2$ (ii) $x^2 + 1$ (iii) $\{0, 1, 4, 9, 16\}$ (iv) $\{1, 2, 5, 10\}$

8. d)

(i) $\frac{1}{3x+1}$ (iii) $\{\frac{1}{37}, \frac{1}{31}, \frac{1}{25}, \frac{1}{19}, \frac{1}{13}\}$
(ii) $\frac{3}{x} + 1$ (iv) $\{\frac{5}{4}, \frac{13}{10}, \frac{11}{8}, \frac{3}{2}, \frac{7}{4}\}$

8. e)

(i) $\sin(\frac{x}{2})$ (ii) $\frac{1}{2} \sin x$ (iii) $\{0, 1, \frac{\sqrt{2}}{2}\}$ (iv) $\{-\frac{1}{2}, 0, \frac{1}{2}\}$

9. a)

(i) $2x - 2$ (ii) $2x - 1$ (iii) $(-2, \infty)$ (iv) $(-1, \infty)$

9. b)

(i) $3x + 1$ (ii) $3x + 3$ (iii) $[-2, \infty)$ (iv) $[0, \infty)$

9. c)

(i) $x + 3$ (ii) $x + 9$ (iii) $[6, \infty)$ (iv) $[12, \infty)$

9. d)

(i) $(x - 2)^2$ (ii) $x^2 - 2$ (iii) $[0, \infty)$ (iv) $[-2, \infty)$

9. e)

(i) 2^{x+1} (ii) $2^x + 1$ (iii) $[2, \infty)$ (iv) $[2, \infty)$

10. a)

(i) Function (ii) $D = \{1, 2, 4, 5, 7\}; R = \{2, 3, 5, 6, 8\}$

10. b)

(i) Function (ii) $D = \{-1, 0, 1, 2, 3\}; R = \{0, 1, 4, 9\}$

10. c)

(i) Function

(ii) $D = \{5, 6, 8, 9, 10\}; R = \{5\}$

10. d)

(i) Not a function

(ii) n/a

10. e)

(i) Not a function

(ii) n/a

10. f)

(i) Function

(ii) $D = \{2, 3, 4, 5, 6\}; R = \{4, 8, 16, 32, 64\}$

10. g)

(i) Function

(ii) $D = \{1, 2, 3, 4, 5\}; R = \{5\}$

10. h)

(i) Not a function

(ii) n/a

11.

a) \mathbb{R}

c) $[3, \infty)$

e) $\mathbb{R} \setminus \{1\}$

g) $\{x \in \mathbb{R} : x \neq 2, 5\}$

b) \mathbb{R}

d) $\mathbb{R} \setminus \{2\}$

f) \mathbb{R}

h) $[\frac{5}{2}, \infty)$

12.

a) Many-to-one

c) Many-to-one

e) One-to-one

g) One-to-one

b) One-to-one

d) Many-to-one

f) One-to-one

h) One-to-one

13.

a) (i) $x - 1$

c) (i) $3x - 1$

e) (i) $\frac{2x-1}{x+3}$

b) (i) $\frac{x-5}{2}$

d) (i) $\frac{1-5x}{2x-1}$

f) (i) $\frac{-6x+10}{x-2}$

14. a)

(i) $C = [4, \infty)$

(ii) $g^{-1} = x - 3; D_{g^{-1}} = [4, \infty); C_{g^{-1}} = [1, \infty)$

14. b)

(i) $C = [2, 32]$

(ii) $g^{-1} = \frac{x-2}{3}; D_{g^{-1}} = [2, 32]; C_{g^{-1}} = [0, 10]$

14. c)

(i) $C = [0, -16)$

(ii) $g^{-1} = 4 - x; D_{g^{-1}} = [0, -16); C_{g^{-1}} = [4, 20)$

14. d)

(i) $C = (0, 10)$

(ii) $g^{-1} = \frac{x+6}{2}; D_{g^{-1}} = (0, 10); C_{g^{-1}} = (3, 8)$

14. e)

(i) $C = [\frac{1}{6}, 1]$

(ii) $g^{-1} = \frac{4x+1}{x}; D_{g^{-1}} = [\frac{1}{6}, 1]; C_{g^{-1}} = [5, 10]$

14. f)

(i) $C = [0, 4]$

(ii) $g^{-1} = 1 + x^2; D_{g^{-1}} = [0, 4]; C_{g^{-1}} = [1, 17]$