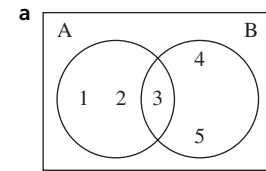


# Answers

## Chapter 0. Exercise 1

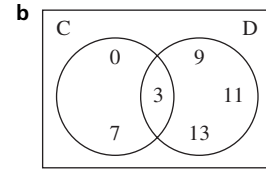
1 a  $\{x: x \leq 2, x \in \mathbb{R}\}$  b  $\{x: x \geq -2, x \in \mathbb{R}\}$  c  $\{x: x > 1, x \in \mathbb{R}\}$  d  $\{x: -1 \leq x \leq 3, x \in \mathbb{R}\}$

2 Venn diagrams



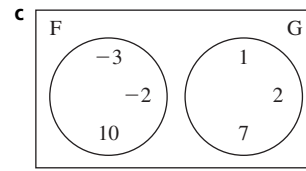
$$A \cap B = \{3\},$$

$$A \cup B = \{1, 2, 3, 4, 5\}$$



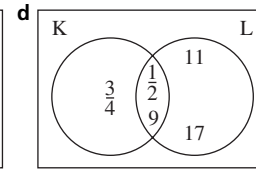
$$C \cap D = \{3\},$$

$$C \cup D = \{0, 3, 7, 9, 11, 13\}$$



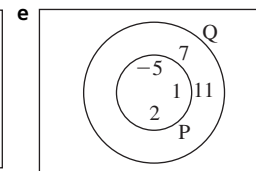
$$F \cap G = \emptyset,$$

$$F \cup G = \{-3, -2, 1, 2, 7, 10\}$$



$$K \cap L = \left\{\frac{1}{2}, 9\right\},$$

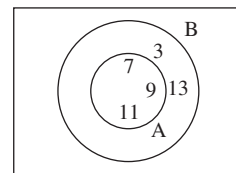
$$K \cup L = \left\{\frac{1}{2}, \frac{3}{4}, 9, 11, 17\right\}$$



$$P \cap Q = \{-5, 1, 2\},$$

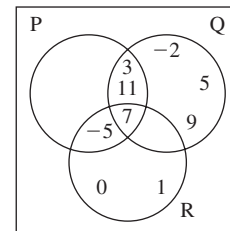
$$P \cup Q = \{-5, 1, 2, 7, 11\}$$

3 Venn diagram



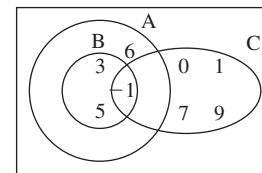
$$A = \{7, 9, 11\}$$

4 Venn diagram



$$P \cup Q = \{-5, -2, 3, 5, 7, 9, 11\}, P \cap Q \cap R = \{7\}$$

5 Venn diagram

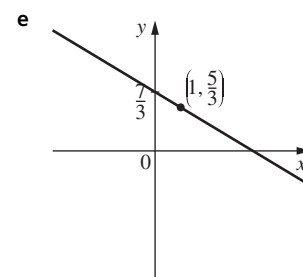
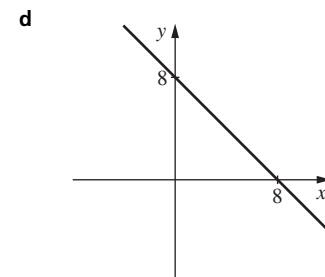
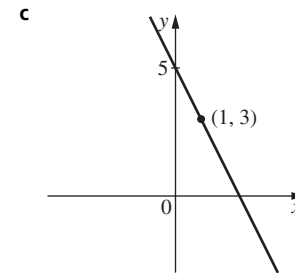
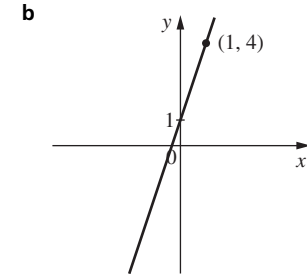
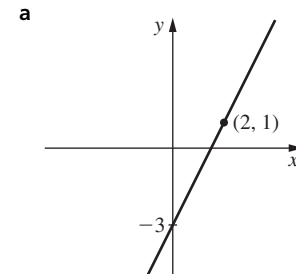


$$B \cup C = \{-1, 0, 1, 3, 5, 7, 9\}, A \cap B \cap C = \{-1\}$$

## Chapter 0. Exercise 2

1 a  $m = 2$  b  $m = \frac{5}{4}$  c  $m = \frac{9}{4}$  d  $m = -\frac{7}{3}$  e  $m = -2$  f  $m = 0$

2 Graphs



3 a  $y = \frac{7}{3}x + \frac{5}{3}$  b  $y = \frac{3}{5}x + \frac{13}{5}$  c  $y = 3x + 11$  d  $y = -2x + 6$  e  $y = -\frac{3}{4}x + \frac{15}{4}$  f  $y = -2$

4 a  $3y - x - 10 = 0$  b  $2y + 7x + 7 = 0$  c  $4y - 5x + 3 = 0$  5 a  $45^\circ$  b  $71.6^\circ$  c  $117^\circ$  d  $53.1^\circ$

6  $y = \sqrt{3}x - 3\sqrt{3} + 1$  7  $y = 3x - 2$  8  $y = -\frac{1}{4}x + \frac{13}{4}$  9  $y = 2x + 1$  10 a  $(4, 4)$  b  $\left(1, \frac{9}{2}\right)$  c  $\left(-3, -\frac{9}{2}\right)$  d  $(4, 2)$  e  $\left(-2, \frac{9}{2}\right)$

11 a  $\sqrt{52}$  b  $\sqrt{41}$  c  $\sqrt{61}$  d 6 e  $\sqrt{205}$  12 a  $M(-2, 3)$  b  $AB = 6\sqrt{5}$  c  $y = 2x + 7$  d  $y = -\frac{1}{2}x + 2$  e  $153^\circ$

Chapter 0. Exercise 3

- 1 **a**  $50^\circ$    **b**  $x = 13.9$    **2 a**  $x = 120^\circ, y = 60^\circ$    **b**  $x = 45^\circ, y = 5.66$    **3 a**  $x = 14.3$    **b**  $x = 31.0^\circ$   
**4 a**  $x = 50^\circ, y = 90^\circ, z = 40^\circ$    **b**  $x = 55^\circ, y = 70^\circ, z = 35^\circ$    **5 a**  $x = 8.60$    **b**  $x = 68.9^\circ$   
**7 a**  $x = 12.5$    **b**  $x = 5.37$    **c**  $x = 49.1^\circ$    **8**  $d = 5\text{ cm}$    **9** AB is longer by 1.29 cm

Chapter 0. Exercise 4

- 1 **a**  $2\sqrt{5}$    **b**  $4\sqrt{2}$    **c**  $3\sqrt{7}$    **d**  $2\sqrt{11}$    **e**  $10\sqrt{3}$    **2 a**  $5\sqrt{5}$    **b**  $7\sqrt{2}$    **c**  $4\sqrt{2}$    **d**  $27\sqrt{3}$    **e**  $6\sqrt{2}$   
**3 a**  $3\sqrt{2}$    **b**  $4\sqrt{6}$    **c**  $10\sqrt{2}$    **d** 30   **e**  $15\sqrt{15}$    **4 a**  $4 + 4\sqrt{2}$    **b**  $6 + 3\sqrt{3}$    **c**  $12 - 4\sqrt{2}$    **d**  $7\sqrt{3} - 28$    **e**  $3\sqrt{2} + 2$   
**4 f**  $6 + 3\sqrt{2} + 2\sqrt{5} + \sqrt{10}$    **g**  $19 - 18\sqrt{3}$    **h**  $7 + 4\sqrt{3}$    **i**  $32 - 10\sqrt{7}$    **5**  $x = \sqrt{18 + 6\sqrt{2} + 4\sqrt{3}}$   
**6 a**  $\frac{2\sqrt{3}}{3}$    **b**  $\frac{3\sqrt{5}}{5}$    **c**  $2\sqrt{2}$    **d**  $\frac{7\sqrt{18}}{18}$    **e**  $\frac{\sqrt{15}}{3}$    **f**  $\frac{5\sqrt{3}}{3}$    **g**  $\sqrt{3} + 1$    **h**  $2\sqrt{5} - 2$    **i**  $\frac{36 + 12\sqrt{2}}{7}$   
**6 j**  $2\sqrt{3} + 2\sqrt{2}$    **k**  $-2 - \sqrt{5} + 2\sqrt{3} + \sqrt{15}$    **l**  $6 - 3\sqrt{3} - 2\sqrt{5} + \sqrt{15}$   
**7 a**  $a^{10}$    **b**  $k^3$    **c**  $p^8$    **d**  $z^{\frac{11}{2}}$    **e**  $x^4$    **f**  $8k^2$    **g**  $8k^7$    **h**  $x^{12}$    **i**  $243p^{10}$    **j**  $196k^{-12}$    **k**  $x^5y^{10}$    **l**  $p^{-8}q^{-12}$    **m**  $k^{\frac{3}{2}}$    **n**  $12x^2$   
**8 a**  $x^{-1} - 4$    **b**  $x^4 - x^{-2}$    **c**  $\frac{1}{2}x^5 + \frac{1}{2}x$    **d**  $3x^{\frac{3}{2}} + 4x^{-\frac{1}{2}}$    **e**  $8x^{\frac{5}{6}} - 3x^{\frac{2}{3}}$    **f**  $x + 6 + 9x^{-1}$    **g**  $\frac{1}{3} + \frac{1}{3}x^{-1} - 2x^{-2}$   
**8 h**  $\frac{9}{4}x^{-1} - 3 + x$    **i**  $25x^{-2} - 40x^{-1} + 16$    **j**  $x + 1 - 3x^{-1} - 3x^{-2}$    **k**  $x^{\frac{3}{2}} + 4x^{\frac{1}{2}} + 4x^{-\frac{1}{2}}$

Chapter 0. Exercise 5

- 1  $8x - 10$    **2**  $11y + 17$    **3**  $2a + 7$    **4**  $x^2 + x - 2$    **5**  $-3x^2 - 16x$    **6**  $6y^2 + 21y - 72$    **7**  $5y + 19z - 45$    **8**  $28a^2 + 88a$   
**9**  $xy + 4x + 2y + 8$    **10**  $ab - 7a - 6b + 42$    **11**  $6ef - 2e + 15f - 5$    **12**  $30st - 85s + 72t - 204$    **13**  $x^2 + 13x + 40$   
**14**  $y^2 + y - 56$    **15**  $y^2 - 49$    **16**  $a^2 - 8a + 16$    **17**  $2x^2 + 3x - 5$    **18**  $15b^2 + b - 6$    **19**  $-15t^2 + 17t + 4$    **20**  $-4s^2 + 16s - 7$   
**21**  $-9y^2 + 4$    **22**  $4x^2 - 36x + 81$    **23**  $7t^2 + 6t + 1$    **24**  $x^2 + 4y^2$  25.   **25**  $10x^2 + 25x - 15$    **26**  $-3a^2 + 2a + 8$    **27**  $-r^2 - 8r$   
**28**  $x^2 - y^2 - 2x - 6y - 8$    **29**  $2x^2 + 2x^2y + xy^2 - 4xy - 5x$    **30**  $-a^2 - ab - ac + 3a + 3b + 3c$    **31**  $6x^2 - 35y^2 - 11xy - 8x + 59y - 14$   
**32**  $2a^2 - 2a^2b + 4ab^2 + 24a - 20b - 18ab + 70$    **33**  $6x^2 - 24y^2 + 18z^2 + 18xy - 24xz - 66yz$

Chapter 0. Exercise 6

- 1  $3(x - 5)$    **2**  $x(5x - 2)$    **3**  $3(a + 5b)$    **4**  $2xy(y + 6x)$    **5**  $5y(2x + 3 - x^2)$    **6**  $(a + 2d)(c + 2b)$    **7**  $(2c + d)(a - 3b)$   
**8**  $(4y - z)(x - 2y)$    **9**  $(4y - 3h)(3e + 2f)$    **10**  $(7s + x)(s - 5t)$    **11**  $(x + 1)(x + 2)$    **12**  $(x + 3)(x + 2)$    **13**  $(x + 7)(x - 2)$   
**14**  $(x - 11)(x + 2)$    **15**  $(x - 7)(x - 5)$    **16**  $(x + 3)(x + 2)$    **17**  $(x + 6)(x + 2)$    **18**  $(x - 8)(x + 1)$    **19**  $(x + 4)(x - 3)$   
**20**  $(x - 6)(x - 3)$    **21**  $2(x + 3)(x + 2)$    **22**  $3(x - 4)(x + 3)$    **23**  $(2x + 1)(x + 2)$    **24**  $(2x + 5)(x + 4)$    **25**  $(3x - 1)(x + 2)$   
**26**  $(5x - 4)(x + 2)$    **27**  $(3x - 5)(x + 5)$    **28**  $(2x + 1)(2x + 3)$    **29**  $(3x + 1)(2x + 5)$    **30**  $(4x + 1)(x - 8)$    **31**  $(4x + 3)(3x - 4)$   
**32**  $(7x - 5)(4x - 3)$

Chapter 0. Exercise 7

- 1  $\frac{1}{4}$    **2**  $\frac{5}{3}$    **3**  $\frac{x^2}{y}$    **4**  $\frac{a - 6}{2a - 3}$    **5**  $\frac{x - 6}{x + 5}$    **6**  $\frac{x - 3}{x - 1}$    **7**  $\frac{12}{p + 3q}$    **8**  $\frac{6x^3}{y^2}$    **9**  $10st^4$    **10**  $4x$    **11**  $\frac{r}{3}$    **12**  $\frac{1}{2(2x + 1)}$    **13**  $\frac{5}{3x - 1}$   
**14**  $\frac{7a^6}{18}$    **15**  $\frac{a^4}{c^2}$    **16**  $\frac{x + 2}{9}$    **17**  $\frac{2g - 3f}{fg}$    **18**  $\frac{z^2 + 1}{z}$    **19**  $\frac{18x - 5}{12}$    **20**  $\frac{2 \sin B + 3 \sin A}{\sin A \sin B}$    **21**  $\frac{196y + 1}{28y}$    **22**  $\frac{z(a^2 + b^2)}{a^2b^2}$   
**23**  $\frac{2y}{y^2 - 1}$    **24**  $\frac{9x + 30}{(x + 4)(x + 3)}$    **25**  $\frac{3 - 2a}{a^2 - 4}$    **26**  $\frac{-2(1 + 3z)}{(2z + 1)^2}$    **27**  $\frac{6(2 + x)}{(2x + 1)^2}$    **28**  $\frac{29y - 78}{12(y + 3)(3y - 2)}$    **29**  $\frac{2x^2 - 21x + 13}{(x - 1)(x + 5)(x - 2)}$   
**30**  $\frac{5 - 3y + 3x}{y^2 - x^2}$    **31**  $\frac{13t - 30}{(t + 1)(t - 5)}$    **32**  $\frac{-1}{x + 1}$    **33**  $\frac{2x(x + 4)}{(x + 3)(x - 2)}$    **34**  $\frac{3}{x(x + 5)}$    **35**  $\frac{-2x}{x^2 - 9}$    **36**  $\frac{6x^2 + 7x - 1}{(3x + 2)(x + 3)}$   
**37**  $\frac{2x(1 + x + 2y)}{(x + 3y)(x + 2y)}$    **38**  $\frac{2(x - 3)(x + 2)^2}{9(x + 1)(x - 2)}$

Chapter 0. Exercise 8

- 1  $x = 24$    **2**  $x = \frac{5}{4}$    **3**  $x = -\frac{2}{3}$    **4**  $x = \frac{12}{5}$    **5**  $x = 210$    **6**  $x = 28$    **7**  $x = -1$    **8**  $x = 2$    **9**  $x = \frac{16}{11}$    **10**  $a = \frac{9}{7}$    **11**  $b = -\frac{13}{4}$   
**12**  $t = -32$    **13**  $p = -\frac{17}{11}$    **14**  $x = \frac{1}{7}$    **15**  $y = -\frac{23}{6}$    **16**  $a = \frac{5}{4}$    **17**  $x = -\frac{3}{53}$    **18**  $x = \frac{43}{26}$    **19**  $x = -\frac{125}{24}$    **20**  $x = -10$   
**21**  $x = -25$    **22**  $x = \frac{29}{2}$    **23**  $x = -\frac{27}{16}$    **24**  $x = -\frac{61}{58}$

Chapter 0. Exercise 9

- 1  $z = \frac{2y - x}{3}$    **2**  $c = \frac{2a - y}{b}$    **3**  $y = x + 5z$    **4**  $a = \frac{3c^2}{b - 2c}$    **5**  $x = \frac{a - 3b}{a + 2b - 3}$    **6**  $y = \frac{4xz}{x + z}$    **7**  $f = \frac{hk - g}{3}$    **8**  $z = \frac{5 + 2a - b}{a + b}$   
**9**  $b = \frac{135a^2 + 93a + 2}{2(a - 1)}$    **10**  $a = \frac{3b - 92}{138 + 3b}$    **11**  $x = \frac{a^2}{b - 1}$    **12**  $m = n + p$    **13**  $y = \frac{5}{2}\left(\frac{1 - 3z}{z - 6}\right)$    **14**  $z = \frac{12y + 5}{2y + 15}$   
**15**  $a = \frac{x(3c - b)}{4c^2x^2 - x^2 + b - 2c}$    **16**  $t = \pm\sqrt{\frac{p - 3}{q}}$    **17**  $b = \pm\sqrt{\frac{a(1 + 2a)}{3}}$    **18**  $t = \pm\sqrt{\frac{s(5s - 1)}{9s^3}}$    **19**  $b = \pm\sqrt{\frac{3a - a + 2}{6}}$   
**20**  $b = \pm\sqrt{\frac{7 - 3a^2 - 14a}{21 - 45a}}$

Chapter 0. Exercise 10

- 1  $x = 2, y = 1$    **2**  $x = 2, y = 5$    **3**  $x = 1, y = -1$    **4**  $x = -2, y = -1$    **5**  $x = 1, y = 2$    **6**  $x = 4, y = 3$    **7**  $x = -1, y = -3$   
**8**  $x = 2, y = 3$    **9**  $x = \frac{1}{2}, y = \frac{1}{2}$    **10**  $x = -\frac{121}{17}, y = -\frac{4}{17}$    **11**  $x = 1, y = 4$    **12**  $x = 2, y = 5$    **13**  $x = 1, y = -3$    **14**  $x = -2, y = -3$   
**15**  $x = \frac{3}{2}, y = -\frac{1}{2}$    **16**  $x = 1, y = 7$    **17**  $x = 1, y = -2$    **18**  $x = -1, y = -3$    **19**  $x = -1, y = -4$    **20**  $x = \frac{13}{5}, y = 2$