Exercise 1I

1 Classify each of these real numbers as rational or irrational.

a 83 **b** $\frac{4}{9}$ **c** $\frac{2\pi}{3}$ **d** -0.96

e $-0.\dot{4}\dot{5}$ **f** e^5 **g** $-4\sqrt{81}$ **h** $\frac{\sqrt{5}}{7}$

i $1.247\dot{}$ **j** $\sqrt{18}$

2 Which of the numbers from question 1 are:

a integers

b natural numbers?

3 Write each rational number from question 1 in the form $\frac{a}{b}$, where a and b are integers, and $b \neq 0$.

Exercise 1L

1 List the elements in each set.

a A, the set of all the factors of 72.

b B, the set of all the prime factors of 72.

c C, the set of all even prime numbers.

d D, the set of all the even multiples of 7.

e $E = \{x \mid x \in \mathbb{Z}, |x| < 4\}$

f $F = \{x \mid x \in \mathbb{N}, x \geq 20\}$

g G, the set of all prime numbers that are multiples of 4.

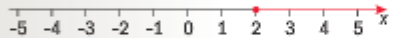
Exercise 1N

1 Write each interval using set notation and inequalities.

a

b

c



d

2 Shade the number line to indicate the interval of real numbers given by the set.

a $\{x \mid x \in \mathbb{R}, x \leq 0\}$ **b** $\{x \mid x \in \mathbb{R}, -3 \leq x < 2\}$

c $\{x \mid x \in \mathbb{R}, x > -1\}$ **d** $\{x \mid x \in \mathbb{R}, -5 < x < 1\}$

Exercise 1M

1 Let $A = \{1, 2, 3, 4, 5, 6\}$, and let $B = \{4, 5\}$.

a Is B a subset of A? Explain.

b Are the sets A and B disjoint? Explain.

c List the intersection of sets A and B.

d List the union of sets A and B.

2 Let $A = \{x \mid x \text{ is a factor of } 36\}$ and $B = \{x \mid x \text{ is a factor of } 15\}$.

a List the elements of each set.

b Is B a subset of A? Explain.

c Are the sets A and B disjoint? Explain.

d List the intersection of sets A and B.

e List the union of sets A and B.

3 Let $A = \{x \mid x \in \mathbb{Z}, x > 16\}$ and $B = \{x \mid x \text{ is a multiple of } 20\}$.

a List the elements of each set.

b Is B a subset of A? Explain.

c Are the sets A and B disjoint? Explain.

d List the intersection of sets A and B.

e List the union of sets A and B.

Exercise 1K

1 Write these in standard form

a 1475 **b** 231000

c 2.8 billion **d** 0.35×10^6

e 73.5×10^5

2 Write these as ordinary numbers

a 6.25×10^4 **b** 4.2×10^8

c 3.554×10^2

3 Write these in standard form

a 0.0001232 **b** 0.00004515

c 0.617 **d** 0.75×10^{-5}

e 34.9×10^{-5}

4 Write these as ordinary numbers

a 3.5×10^{-7} **b** 8.9×10^{-8}

c 1.253×10^{-2}

Exercise 2A

Simplify.

8. $\sqrt{28}$ **9.** $\dfrac{\sqrt{40}}{\sqrt{8}}$ **10.** $\dfrac{4\sqrt{12}}{2\sqrt{2}}$

11. $2\sqrt{3}\times 3\sqrt{5}$ **12.** $4\sqrt{2}+7\sqrt{2}$

13. $9\sqrt{5}-4\sqrt{5}$ **14.** $\sqrt{20}-\sqrt{5}+\sqrt{40}$

15. Without using a calculator, arrange the following in order from least to greatest.

$2\sqrt{32},\ 3\sqrt{16},\ 7\sqrt{3},\ 9\sqrt{2}$

Expand and simplify.

16. $\sqrt{3}(2\sqrt{6}-4\sqrt{15})$

17. $(4\sqrt{3}+7\sqrt{2})(\sqrt{3}-\sqrt{2})$

18. $(\sqrt{3}+\sqrt{7})(\sqrt{3}-\sqrt{7})$

19. $(\sqrt{2}-2\sqrt{5})^2$

Simplify.

20. $\dfrac{10}{\sqrt{5}}$ **21.** $\dfrac{2}{\sqrt{6}-\sqrt{3}}$

Simplify.

22. $(2x^3y^{-1})^3$ **23.** $(-3x^3y^5)(4x^{-1}y^2)$

24. $(-9a^5b^2c)\div(-3abc)$ **25.** $\dfrac{48x^2y^5}{(2xy^{-3})(8xy)}$

Evaluate.

26. $81^{\frac{1}{2}}$ **27.** $\left(\dfrac{8}{27}\right)^{\frac{1}{3}}$ **28.** $64^{-\frac{1}{3}}$

29. $(-0.027)^{\frac{2}{3}}$ **30.** $16^{\frac{5}{4}}$ **31.** $\sqrt{\sqrt[3]{64}}$

32. Measurement The area of a rectangle is 20. One dimension is $\sqrt{5}+\sqrt{3}$. What is the other?

Exercise 2D

1 Factorize these quadratic expressions.

a $x^2+11x+28$ **b** $x^2-14x+13$ **c** x^2-x-20

d x^2+2x-8 **e** $x^2+13x+36$ **f** $x^2-7x-18$

2 Factorize these quadratic expressions.

a $2x^2-9x+9$ **b** $3x^2+7x+2$ **c** $5x^2-17x+6$

d $4x^2-x-3$ **e** $3x^2-7x-6$ **f** $14x^2-17x+5$

3 Factorize these quadratic expressions.

a x^2-9 **b** x^2-100 **c** $4x^2-81$

d $25x^2-1$ **e** m^2-n^2 **f** $16x^2-49y^2$

Exercise 2L

Combine these fractions, simplifying your answer.

1 $\dfrac{2}{x+7}+\dfrac{3x-1}{x+7}$ **2** $\dfrac{4x}{2x+2}-\dfrac{3x-1}{2x+2}$

3 $\dfrac{3x+9}{3x+4}+\dfrac{3x-1}{3x+4}$ **4** $\dfrac{2x}{x+5}+\dfrac{x+1}{2x-1}$

5 $\dfrac{4}{x}+\dfrac{2x+1}{x+2}$ **6** $\dfrac{2x-1}{x-2}-\dfrac{3x}{4x+3}$

7 $\dfrac{x+1}{5x+1}+\dfrac{2x}{2x-5}$ **8** $\dfrac{x+5}{x-4}-\dfrac{x-2}{x+2}$

Exercise 2M

Solve the equations.

1 $\dfrac{x}{3}+\dfrac{1}{6}=\dfrac{x}{4}+\dfrac{1}{4}$ **2** $\dfrac{1}{k}+\dfrac{1}{4}=\dfrac{9}{4k}$ **3** $\dfrac{1}{6}=\dfrac{5}{6}-\dfrac{1}{x}$

4 $\dfrac{3}{5}-\dfrac{2x}{4}=\dfrac{x-1}{2}$ **5** $\dfrac{3x}{4}+\dfrac{x+2}{3}=\dfrac{x-1}{8}$

Exercise 1I

1 a rational b rational
c irrational d rational
e rational f irrational
g rational h irrational
I rational j irrational

2 a a and g b a

3 a $83 = \frac{83}{1}$ b $\frac{4}{9}$
c - d $\frac{-24}{25}$
e $-0.45 = \frac{-5}{11}$ f -
g $-4 \times 9 = -36$ h -
I $\frac{1123}{900} = 1\frac{223}{900}$
j -

Exercise 1L

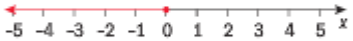
1 a A = {1, 2, 3, 4, 6, 8, 12, 18, 24, 36, 72}
b B = {2, 3}
c C = {2}
d D = {14, 28, 42, 56, 70,... }
e E = {–3, –2, –1, 1, 2, 3}
f F = {20, 21, 22, 23, 24,...}
g G = {}

2 a 11
b 2
c 1
d infinite
e 6
f infinite
g 0

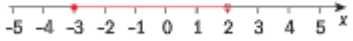
Exercise 1N

1 a $x < 2$
b $-1 \leq x < 5$
c $x > 2$
d $-4 \leq x \leq 3$

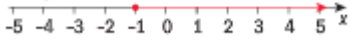
2 a



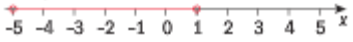
b



c



d



Exercise 1M

1 a Yes, all the elements of B are contained in A
b No, they have elements in common
c {4, 5}
d {1, 2, 3, 4, 5, 6}

2 a A = {1, 2, 3, 4, 6, 9, 12, 18, 36} and B = {1, 3, 5, 15}
b No, they have different elements
c No, they have some elements in common
d {1, 3}
e {1, 2, 3, 4, 5, 6, 9, 12, 15, 18, 36}

3 a A = {17, 18, 19, 20, 21, 22...} and B = {20, 40, 60, 80...}
b Yes
c No, they have some elements in common
d {20, 40, 60, 80...} = B
e {17, 18, 19, 20, 21, 22...} = A

Exerci se 1K

1 a 1.475×10^3 b 2.31×10^5
c 2.8×10^9 d 3.5×10^4
e 7.35×10^6

2 a 62500 b 420 000 000
c 355.4

3 a 1.232×10^{-4}
b 4.515×10^{-5}
c 6.17×10^{-1}
d 7.5×10^{-6}
e 3.49×10^{-4}

4 a 0.00000035
b 0.000000089
c 0.01253

Exercise 2A

8. $2\sqrt{7}$ **9.** $\sqrt{5}$ **10.** $2\sqrt{6}$ **11.** $6\sqrt{15}$ **12.** $11\sqrt{2}$ **13.** $5\sqrt{5}$
14. $\sqrt{5} + 2\sqrt{10}$ **15.** $2\sqrt{32}$, $3\sqrt{16}$, $7\sqrt{3}$, $9\sqrt{2}$
16. $6\sqrt{2} - 12\sqrt{5}$ **17.** $3\sqrt{6} - 2$ **18.** -4 **19.** $22 - 4\sqrt{10}$
20. $2\sqrt{5}$ **21.** $\frac{2\sqrt{6} + 2\sqrt{3}}{3}$ **22.** $8x^9y^{-3}$ **23.** $-12x^2y^7$
24. $3a^4b$ **25.** $3y^7$ **26.** 9 **27.** $\frac{2}{3}$ **28.** $\frac{1}{4}$ **29.** 0.09 **30.** 32
31. 2 **32.** $10\sqrt{5} - 10\sqrt{3}$

Exercise 2D

1 a $(x+4)(x+7)$
b $(x-1)(x-13)$
c $(x+4)(x-5)$
d $(x+4)(x-2)$
e $(x+4)(x+9)$
f $(x+2)(x-9)$

2 a $(2x-3)(x-3)$
b $(3x+1)(x+2)$
c $(5x-2)(x-3)$
d $(4x+3)(x-1)$
e $(3x+2)(x-3)$
f $(7x-5)(2x-1)$

3 a $(x-3)(x+3)$
b $(x-10)(x+10)$
c $(2x-9)(2x+9)$
d $(5x+1)(5x-1)$
e $(m+n)(m-n)$
f $(4x-7)(4x+7)$

Exercise 2L

1 $\frac{3x+1}{x+7}$

2 $\frac{x+1}{2x+2}$

3 $\frac{6x+8}{3x+4}$

4 $\frac{2x(2x-1)+(x+1)(x+5)}{(x+5)(2x-1)}$
$=\frac{2x^2-2x+x^2+6x+5}{2x^2+9x-5}$
$=\frac{3x^2+4x+5}{2x^2+9x-5}$

5 $\frac{4(x+2)+x(2x+1)}{x(x+2)}$
$=\frac{4x+8+2x^2+x}{x^2+2x}$
$=\frac{2x^2+5x+8}{x^2+2x}$

6 $\frac{(2x-1)(4x+3)-3x(x-2)}{(x-2)(4x+3)}$
$=\frac{8x^2+2x-3-3x^2+6x}{4x^2-5x-6}$
$=\frac{5x^2+8x-3}{4x^2-5x-6}$

7 $\frac{(x+1)(2x-5)+2x(5x+1)}{(5x+1)(2x-5)}$
$=\frac{2x^2+2x-5x-5+10x^2+2x}{10x^2+2x-25x-5}$
$=\frac{12x^2-x-5}{10x^2-23x-5}$

8 $\frac{(x+5)(x+2)-(x-4)(x-2)}{(x-4)(x+2)}$
$=\frac{x^2+7x+10-x^2+6x-8}{x^2+2x-8}$
$=\frac{13x+2}{x^2+2x-8}$

Exercise 2M

1. x=1

2. k=5

3. x=1.5

4. x=1.1

5. x=-19/23