

UNIT 3 *Indices and Standard Form* **Extra Exercises 3.1**

1. Calculate:

- (a) 4^2 (b) 5^2 (c) 5^3
(d) 8^2 (e) 10^4 (f) 2^5

2. Copy and complete each of the following statements:

- (a) $7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^{\square}$
(b) $10 \times 10 \times 10 \times 10 \times 10 = 10^{\square}$
(c) $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^{\square}$
(d) $6 \times 6 = 6^{\square}$
(e) $11 \times 11 \times 11 = 11^{\square}$
(f) $100 \times 100 \times 100 \times 100 \times 100 = 100^{\square}$

3. Copy and complete each of the following statements:

- (a) $1000 = 10^{\square}$ (b) $4 = 2^{\square}$
(c) $1000000 = 10^{\square}$ (d) $32 = 2^{\square}$
(e) $49 = 7^{\square}$ (f) $64 = 4^{\square}$
(g) $27 = 3^{\square}$ (h) $17 = 17^{\square}$

UNIT 3 *Indices and Standard Form* **Extra Exercises 3.2**

1. Copy each of the following statements and fill in all the missing numbers:

(a) $3^6 \times 3^7 = 3^{\square}$

(b) $8^4 \times 8^3 = 8^{\square}$

(c) $5^{12} \div 5^3 = 5^{\square}$

(d) $11^{14} \div 11^3 = 11^{\square}$

(e) $(2^3)^5 = 2^{\square}$

(f) $(5^2)^4 = 5^{\square}$

(g) $12^6 \times 12^4 = 12^{\square}$

(h) $14^{11} \div 14^5 = 14^{\square}$

2. Copy and complete each of the following statements:

(a) $2^3 \times 2^{\square} = 2^8$

(b) $3^8 \div 3^{\square} = 3^2$

(c) $(5^2)^{\square} = 5^8$

(d) $(5^{\square})^4 = 5^{28}$

(e) $7^{\square} \div 7^4 = 7^5$

(f) $8^{\square} \times 8^3 = 8^{11}$

(g) $(3^{\square})^4 = 3^{24}$

(h) $7^{\square} \div 7^2 = 7^8$

3. Simplify each of the following expressions:

(a) $x^2 \times x^3$

(b) $x^6 \times x^7$

(c) $p^7 \div p^2$

(d) $(y^2)^3$

(e) $a^6 \div a^4$

(f) $a^7 \times a^4$

(g) $b^{16} \div b^7$

(h) $p^4 \times p^2 \times p^3$

UNIT 3 *Indices and Standard Form* **Extra Exercises 3.3**

1. Write each of the following numbers as a fraction, without using any indices:

- (a) 2^{-4} (b) 8^{-1} (c) 3^{-2}
(d) 7^{-1} (e) 10^{-2} (f) 4^{-2}

2. Copy and complete each of the following statements:

- (a) $\frac{1}{9^6} = 9^{\square}$ (b) $\frac{1}{49} = \frac{1}{7^{\square}} = 7^{\square}$
(c) $\frac{1}{1000} = \frac{1}{10^{\square}} = 10^{\square}$ (d) $\frac{1}{8} = \frac{1}{2^{\square}} = 2^{\square}$

3. Calculate, giving your answers as fractions or decimals:

- (a) $10^{-1} + 10$ (b) $2 + 2^{-1}$
(c) $2^{-1} + 3^{-1}$ (d) $6^{-1} + 3^{-1}$
(e) $10^{-1} + 10^{-2}$ (f) $2^{-1} + 2^{-2}$
(g) $5^{-1} + 10^{-1}$ (h) $10^{-2} + 10^{-2}$

4. Simplify each of the following expressions:

- (a) $4^7 \times 4^{-5}$ (b) $3^{-6} \times 3^{10}$
(c) $(2^{-4})^2$ (d) $3^{-5} \div 3^3$
(e) $4^{-7} \times 4^{-3}$ (f) $(5^6)^{-2}$

UNIT 3 *Indices and Standard Form* **Extra Exercises 3.4**

1. Write each of the following numbers in standard form:
 - (a) 400 000
 - (b) 370 000
 - (c) 125 000 000 000
 - (d) 360
 - (e) 20
 - (f) 571 300 000

2. Convert each of the following numbers from standard form to the usual notation:
 - (a) 3.6×10^4
 - (b) 8×10^5
 - (c) 4.21×10^3
 - (d) 5.211×10^2
 - (e) 8.7×10^6
 - (f) 4.8×10^{10}

3. Write each of the following numbers in standard form:
 - (a) 0.0003
 - (b) 0.000047
 - (c) 0.06
 - (d) 0.00321
 - (e) 0.37
 - (f) 0.000003742

4. Convert each of the following numbers from standard form to the usual notation:
 - (a) 6×10^{-3}
 - (b) 4×10^{-5}
 - (c) 6.2×10^{-3}
 - (d) 7.41×10^{-6}
 - (e) 3×10^{-1}
 - (f) 4.231×10^{-2}

UNIT 3 *Indices and Standard Form* **Extra Exercises 3.5**

1. Calculate:

(a) $81^{\frac{1}{2}}$

(b) $1^{\frac{1}{2}}$

(c) $121^{\frac{1}{2}}$

(d) $10000^{\frac{1}{2}}$

(e) $1^{-\frac{1}{2}}$

(f) $64^{-\frac{1}{2}}$

(g) $16^{\frac{1}{4}}$

(h) $125^{-\frac{1}{3}}$

(i) $32^{-\frac{1}{5}}$

(j) $64^{\frac{1}{6}}$

(k) $1000000^{\frac{1}{6}}$

(l) $169^{\frac{1}{2}}$

2. Calculate:

(a) $(12 \times 3)^{\frac{1}{2}}$

(b) $\left(\frac{4 \times 10}{5}\right)^{\frac{1}{3}}$

(c) $(21 \times 3 + 1)^{\frac{1}{3}}$

(d) $(13^2 - 12^2)^{\frac{1}{2}}$

(e) $(49 - 24)^{-\frac{1}{2}}$

(f) $\left(\frac{8 \times 16}{2}\right)^{-\frac{1}{3}}$

3. Calculate:

(a) $4^{\frac{1}{2}} + 16^{-\frac{1}{2}}$

(b) $8^{-\frac{1}{3}} + 4^{-\frac{1}{2}}$

(c) $100^{-\frac{1}{2}} + 25^{-\frac{1}{2}}$

(d) $400^{\frac{1}{2}} + 100^{\frac{1}{2}}$

(e) $8^{\frac{1}{3}} - 4^{\frac{1}{2}}$

(f) $11^2 - 144^{\frac{1}{2}}$

(g) $1^{\frac{1}{10}} + 16^{-\frac{1}{2}}$

(h) $8^{-\frac{1}{3}} + 9^{-\frac{1}{2}}$

Extra Exercises 3.1 Answers

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|----|------------|------------|-------------|------------|
| 1. | (a) 16 | (b) 25 | (c) 125 | |
| | (d) 64 | (e) 10 000 | (f) 32 | |
| 2. | (a) 7^6 | (b) 10^5 | (c) 3^8 | |
| | (d) 6^2 | (e) 11^3 | (f) 100^5 | |
| 3. | (a) 10^3 | (b) 2^2 | (c) 10^6 | (d) 2^5 |
| | (e) 7^2 | (f) 4^3 | (g) 3^3 | (h) 17^1 |

Extra Exercises 3.2 Answers

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|----|----------------------------|-------------------------------|---------------|---------------|
| 1. | (a) 3^{13} | (b) 8^7 | (c) 5^9 | (d) 11^{11} |
| | (e) 2^{15} | (f) 5^8 | (g) 12^{10} | (h) 14^6 |
| 2. | (a) $2^3 \times 2^5 = 2^8$ | (b) $3^8 \div 3^6 = 3^2$ | | |
| | (c) $(5^2)^4 = 5^8$ | (d) $(5^7)^4 = 5^{28}$ | | |
| | (e) $7^9 \div 7^4 = 7^5$ | (f) $8^8 \times 8^3 = 8^{11}$ | | |
| | (g) $(3^6)^4 = 3^{24}$ | (h) $7^{10} \div 7^2 = 7^8$ | | |
| 3. | (a) x^5 | (b) x^{13} | (c) p^5 | (d) y^6 |
| | (e) a^2 | (f) a^{11} | (g) b^9 | (h) p^9 |

Extra Exercises 3.3 Answers

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|----|------------------------------|------------------------------|--------------------------------|------------------------------|
| 1. | (a) $\frac{1}{16}$ | (b) $\frac{1}{8}$ | (c) $\frac{1}{9}$ | |
| | (d) $\frac{1}{7}$ | (e) $\frac{1}{100}$ | (f) $\frac{1}{16}$ | |
| 2. | (a) 9^{-6} | (b) $\frac{1}{7^2} = 7^{-2}$ | (c) $\frac{1}{10^3} = 10^{-3}$ | (d) $\frac{1}{2^3} = 2^{-3}$ |
| 3. | (a) 10.1 or $10\frac{1}{10}$ | (b) 2.5 or $2\frac{1}{2}$ | (c) $\frac{5}{6}$ | (d) 0.5 or $\frac{1}{2}$ |
| | (e) 0.11 or $\frac{11}{100}$ | (f) 0.75 or $\frac{3}{4}$ | (g) 0.3 or $\frac{3}{10}$ | (h) 0.02 or $\frac{1}{50}$ |
| 4. | (a) 4^2 | (b) 3^4 | (c) 2^{-8} | |
| | (d) 3^{-8} | (e) 4^{-10} | (f) 5^{-12} | |
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Extra Exercises 3.4 Answers

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|----|---------------------------|--------------------------|----------------------------|
| 1. | (a) 4×10^5 | (b) 3.7×10^5 | (c) 1.25×10^{11} |
| | (d) 3.6×10^2 | (e) 2×10^1 | (f) 5.713×10^8 |
| 2. | (a) 36 000 | (b) 800 000 | (c) 4210 |
| | (d) 521.1 | (e) 8 700 000 | (f) 48 000 000 000 |
| 3. | (a) 3×10^{-4} | (b) 4.7×10^{-5} | (c) 6×10^{-2} |
| | (d) 3.21×10^{-3} | (e) 3.7×10^{-1} | (f) 3.742×10^{-6} |
| 4. | (a) 0.006 | (b) 0.00004 | (c) 0.0062 |
| | (d) 0.00000741 | (e) 0.3 | (f) 0.04231 |

Extra Exercises 3.5 Answers

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|----|--------------------|-------------------|--------------------|-------------------|
| 1. | (a) 9 | (b) 1 | (c) 11 | (d) 100 |
| | (e) 1 | (f) $\frac{1}{8}$ | (g) 2 | (h) $\frac{1}{5}$ |
| | (i) $\frac{1}{2}$ | (j) 2 | (k) 10 | (l) 13 |
| 2. | (a) 6 | (b) 2 | (c) 4 | |
| | (d) 5 | (e) $\frac{1}{5}$ | (f) $\frac{1}{4}$ | |
| 3. | (a) $2\frac{1}{4}$ | (b) 1 | (c) $\frac{3}{10}$ | (d) 30 |
| | (e) 0 | (f) 109 | (g) $1\frac{1}{4}$ | (h) $\frac{5}{6}$ |