

ZETA MATHS

National 5

Mathematics

Homework Exercises

Units 1 & 2

EXPRESSIONS & FORMULAE AND
RELATIONSHIPS

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INTRODUCTION

The aim of this book is to support learners in their pursuit of excellence in mathematics. Curriculum for Excellence offers learners breadth in learning; this resource is intended to assist learners in developing depth and consolidation of skills.

The resource can be used in a variety of ways: It may be used systematically as learners work through the book progressively doing each of the four exercises from each homework on consecutive days of the week, or it may be used in a more flexible way. This book follows a unit-by-unit approach to National 5 mathematics. The contents page is intended for learners and teachers to keep track of progress through the resource. Learners may use a traffic light system for each of the exercises to monitor progression through each of the experiences and outcomes.

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<p>Exercise 1</p> <p>1. Round to 1 significant figure:</p> <p>a. 9853 b. 5649 c. 10,944</p> <p>d. 0.0826 e. 3.928 f. 18.044</p> <p>2. Round the answers above to 2 significant figures.</p> <p>3. Round to 2 decimal places:</p> <p>a. 8.283 b. 2.788 c. 42.833</p> <p>d. 0.0746 e. 2.937 f. 0.02891</p> <p>4. By rounding to 1 figure accuracy, estimate:</p> <p>a. 4288×1398 b. 2762×0.4365</p>	<p>Exercise 2</p> <p>1. Round to 1 significant figure:</p> <p>a. 8243 b. 1688 c. 11,954</p> <p>d. 0.0826 e. 1.941 f. 29.047</p> <p>2. Round the answers above to 2 significant figures.</p> <p>3. Round to 2 decimal places:</p> <p>a. 6.4531 b. 3.679 c. 1.1843</p> <p>d. 0.0635 e. 1.137 f. 16.0481</p> <p>4. By rounding to 1 figure accuracy, estimate:</p> <p>a. 8987×1287 b. 3581×0.3272</p>
<p>Exercise 3</p> <p>1. Round to 1 significant figure:</p> <p>a. 5664 b. 3687 c. 12,908</p> <p>d. 0.0839 e. 2.966 f. 51.027</p> <p>2. Round the answers above to 2 significant figures.</p> <p>3. Round to 2 decimal places:</p> <p>a. 86.731 b. 4.677 c. 16.993</p> <p>d. 0.0844 e. 1.806 f. 13.007</p> <p>4. By rounding to 1 figure accuracy, estimate:</p> <p>a. 4087×2199 b. 2652×0.2972</p>	<p>Exercise 4</p> <p>1. Round to 1 significant figure:</p> <p>a. 1237 b. 6319 c. 22,945</p> <p>d. 0.0446 e. 1.776 f. 17.338</p> <p>2. Round the answers above to 2 significant figures.</p> <p>3. Round to 2 decimal places:</p> <p>a. 5.5834 b. 2.4592 c. 16.933</p> <p>d. 0.0116 e. 1.766 f. 10.039</p> <p>4. By rounding to 1 figure accuracy, estimate:</p> <p>a. 2266×4294 b. 3382×0.8888</p>

E&F	Rounding and Estimation
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Exercise 1

Simplify these surds as far as possible:

1. $3\sqrt{5} + 6\sqrt{5}$
2. $6\sqrt{7} + 2\sqrt{7} - \sqrt{7}$
3. $\sqrt{12}$
4. $\sqrt{20}$
5. $\sqrt{75}$
6. $\sqrt{6} \times \sqrt{3}$
7. $\sqrt{2} \times \sqrt{5} \times \sqrt{4}$
8. $\sqrt{3} \times \sqrt{10} \times \sqrt{2}$

Exercise 2

Simplify these surds as far as possible:

1. $2\sqrt{3} + 8\sqrt{3}$
2. $4\sqrt{11} + 3\sqrt{11} - \sqrt{11} + 5\sqrt{11}$
3. $\sqrt{24}$
4. $\sqrt{50}$
5. $\sqrt{128}$
6. $\sqrt{11} \times \sqrt{4}$
7. $\sqrt{4} \times \sqrt{2} \times \sqrt{10}$
8. $\sqrt{20} \times \sqrt{5} \times \sqrt{5}$

Exercise 3

Simplify these surds as far as possible:

1. $\sqrt{13} + 2\sqrt{13}$
2. $5\sqrt{3} + 2\sqrt{3} - 8\sqrt{3} - 2\sqrt{3}$
3. $\sqrt{8}$
4. $\sqrt{32}$
5. $\sqrt{48}$
6. $\sqrt{3} \times \sqrt{24}$
7. $\sqrt{5} \times \sqrt{3} \times \sqrt{4}$
8. $\sqrt{30} \times \sqrt{3} \times \sqrt{10}$

Exercise 4

Simplify these surds as far as possible:

1. $7\sqrt{2} + 9\sqrt{2}$
2. $2\sqrt{19} - \sqrt{19} - \sqrt{19} - 12\sqrt{19}$
3. $\sqrt{90}$
4. $\sqrt{300}$
5. $\sqrt{96}$
6. $\sqrt{2} \times \sqrt{8}$
7. $\sqrt{3} \times \sqrt{7} \times \sqrt{2}$
8. $\sqrt{2} \times \sqrt{8} \times \sqrt{7}$

Exercise 1

Simplify these surds as far as possible:

1. $6 + \sqrt{400}$

2. $\sqrt{32} + \sqrt{8}$

3. $2\sqrt{5} + \sqrt{20} + \sqrt{45}$

Rationalise the denominator:

4. $\frac{2}{\sqrt{5}}$

5. $\frac{6}{\sqrt{3}}$

6. $\frac{7}{2\sqrt{5}}$

Exercise 2

Simplify these surds as far as possible:

1. $\sqrt{200} + \sqrt{300}$

2. $\sqrt{12} + \sqrt{8}$

3. $\sqrt{18} + \sqrt{2} + \sqrt{72}$

Rationalise the denominator:

4. $\frac{3}{\sqrt{7}}$

5. $\frac{8}{\sqrt{6}}$

6. $\frac{3}{4\sqrt{11}}$

Exercise 3

Simplify these surds as far as possible:

1. $6\sqrt{3} + \sqrt{27}$

2. $\sqrt{18} + 3\sqrt{2}$

3. $6\sqrt{5} + \sqrt{20} + \sqrt{80}$

Rationalise the denominator:

4. $\frac{3}{\sqrt{7}}$

5. $\frac{8}{\sqrt{15}}$

6. $\frac{5}{2\sqrt{13}}$

Exercise 4

Simplify these surds as far as possible:

1. $20 + \sqrt{1600}$

2. $\sqrt{27} + 2\sqrt{3}$

3. $\sqrt{12} + 7\sqrt{3} + \sqrt{27}$

Rationalise the denominator:

4. $\frac{5}{\sqrt{2}}$

5. $\frac{12}{\sqrt{13}}$

6. $\frac{8}{3\sqrt{3}}$

Exercise 1

Multiply out the brackets and simplify:

1. $\sqrt{3}(\sqrt{3}+2)$

2. $\sqrt{5}(2\sqrt{5}+4)$

3. $(\sqrt{3}+1)^2$

Simplify:

4. $\frac{\sqrt{40}}{\sqrt{2}}$

5. $\sqrt{50}$

6. $\frac{\sqrt{750}}{\sqrt{3}}$

Exercise 2

Multiply out the brackets and simplify:

1. $\sqrt{2}(\sqrt{6}+5)$

2. $\sqrt{3}(3\sqrt{3}+6)$

3. $(\sqrt{2}-1)^2$

Simplify:

4. $\frac{\sqrt{24}}{\sqrt{3}}$

5. $\sqrt{72}$

6. $\frac{\sqrt{120}}{\sqrt{5}}$

Exercise 3

Multiply out the brackets and simplify:

1. $\sqrt{8}(\sqrt{8}+8)$

2. $\sqrt{2}(5\sqrt{2}+1)$

3. $(\sqrt{4}+6)^2$

Simplify:

4. $\frac{\sqrt{63}}{\sqrt{7}}$

5. $\sqrt{225}$

6. $\frac{\sqrt{45}}{9}$

Exercise 4

Multiply out the brackets and simplify:

1. $\sqrt{6}(7\sqrt{6}+10)$

2. $\sqrt{5}(7\sqrt{5}+11)$

3. $(\sqrt{6}-3)^2$

Simplify:

4. $\frac{\sqrt{80}}{\sqrt{2}}$

5. $\sqrt{196}$

6. $\frac{\sqrt{96}}{\sqrt{3}}$

Exercise 1

Simplify the following:

1. $a^4 \times a^3$

2. $5b^3 \times 2b^2$

3. $4a^{10} \times 2a^{-2}$

4. $\frac{b^5}{b^3}$

5. $\frac{12a^3}{4a^{-2}}$

6. $\frac{15b^6}{3b^{-6}}$

7. $(a^3)^2$

8. $(2b^2)^4$

Exercise 2

Simplify the following:

1. $a^2 \times a^7$

2. $2b^5 \times 2b^6$

3. $5a^{-3} \times 7a^6$

4. $\frac{b^8}{b^2}$

5. $\frac{16a^5}{2a^{-4}}$

6. $\frac{14a^2b^3}{7ab^{-2}}$

7. $(a^6)^3$

8. $(3b^3)^2$

Exercise 3

Simplify the following:

1. $a^5 \times a^{10}$

2. $8b^4 \times 3b^7$

3. $3a^{20} \times 6a^{-4}$

4. $\frac{b^{16}}{b^2}$

5. $\frac{16a^3}{12a^{-10}}$

6. $\frac{20a^5b^4}{15a^3b^{-4}}$

7. $(a^8)^5$

8. $(5b^5)^3$

Exercise 4

Simplify the following:

1. $a^3 \times a^6 \times a^4$

2. $6b^{-1} \times b^2 \times b^{-1}$

3. $7a^{15} \times 4a^{-18}$

4. $\frac{b^{24}}{b^{16}}$

5. $\frac{28a^9}{6a^{-5}}$

6. $\frac{50a^9b^3}{10a^8b^{-5}}$

7. $(a^6)^7$

8. $(2b^9)^5$

Exercise 1

Simplify the following:

1. $6a^{-5} \times 2a^{-6}$

2. $\frac{20a^5b^7}{6a^3b^{-3}}$

3. $\frac{5a^2 \times 2a^3}{a^4}$

4. $\frac{2b^{-3} \times 6b^8}{3b^2}$

5. $18a^5 \div 3a^{-4}$

6. $\frac{(2a)^3}{a^2}$

7. $a^{\frac{1}{2}} \times a^2$

Exercise 2

Simplify the following:

1. $12a^{-2} \times 3a^{-4}$

2. $\frac{36a^4b^2}{3ab^{-6}}$

3. $\frac{3a^4 \times 4a^2}{a^2}$

4. $\frac{7b^{-3} \times 2b^{10}}{2b^6}$

5. $20a^4 \div 2a^{-3}$

6. $\frac{(3a)^2}{a}$

7. $a^{\frac{1}{3}} \times a^2$

Exercise 3

Simplify the following:

1. $8a^{-7} \times 3a^{-2}$

2. $\frac{18a^8b^{12}}{4a^2b^{-10}}$

3. $\frac{20a^2 \times 4a^5}{a^{-2}}$

4. $\frac{4b^{-8} \times 5b^{20}}{5b^6}$

5. $75a^{25} \div 5a^{-20}$

6. $\frac{(5a^2)^3}{a^2}$

7. $a^{\frac{1}{5}} \times a^3$

Exercise 4

Simplify the following:

1. $11a^{-10} \times 3a^{-5}$

2. $\frac{25a^8b^{14}}{35a^2b^{-12}}$

3. $\frac{16a^{17} \times 3a^{-12}}{a^3}$

4. $\frac{3b^{-12} \times 8b^5}{2b^{-9}}$

5. $50a^{40} \div 10a^{-30}$

6. $\frac{(2a^4)^3}{2a^7}$

7. $a^{\frac{1}{2}} \times a^{\frac{1}{3}}$

Exercise 1

Change these to a fractional index:

1. (a) $\sqrt[4]{a^3}$ (b) $\sqrt[5]{b^4}$

Find the value of these:

2. (a) $\sqrt[3]{27^2}$ (b) $\sqrt[2]{4^3}$

Expand the brackets:

3. $a^2(a^3 - 3)$

4. $2b^{-5}(b^2 - 6b^8)$

5. $3a^4\left(\frac{1}{a^2} + 2a^{-2}\right)$

6. $3b^{\frac{1}{2}}(2b^{\frac{1}{2}} + 5b^{-\frac{3}{2}})$

7. $a^{\frac{1}{4}}(2a + 5)$

Exercise 2

Change these to a fractional index:

1. (a) $\sqrt[7]{a^5}$ (b) $\sqrt[8]{b^{11}}$

Find the value of these:

2. (a) $\sqrt[3]{64^2}$ (b) $\sqrt[4]{16^3}$

Expand the brackets:

3. $a^6(a^5 + 2)$

4. $3b^{-2}(b^2 - 10b^{12})$

5. $2a^2\left(\frac{1}{a} + 5a^{-9}\right)$

6. $4b^{\frac{1}{2}}(b^{-\frac{1}{2}} + 2b^{-\frac{3}{2}})$

7. $a^{\frac{1}{3}}(3a + 2)$

Exercise 3

Change these to a fractional index:

1. (a) $\sqrt[9]{a^2}$ (b) $\sqrt[13]{b^7}$

Find the value of these:

2. (a) $\sqrt[3]{125^2}$ (b) $\sqrt[5]{32^2}$

Expand the brackets:

3. $a^{15}(a^{16} + 2a)$

4. $6b^{-9}(3b^{-5} + 2b^{20})$

5. $7a^8\left(\frac{2}{a^5} + 3a^{-5}\right)$

6. $8b^{\frac{3}{2}}(4b^{\frac{1}{2}} + 6b^{-\frac{3}{2}})$

7. $a^{\frac{1}{5}}(6a - 5a^2)$

Exercise 4

Change these to a fractional index:

1. (a) $\sqrt[2]{a^{11}}$ (b) $\sqrt[18]{b^{19}}$

Find the value of these:

2. (a) $\sqrt[9]{1^5}$ (b) $\sqrt[3]{1000^2}$

Expand the brackets:

3. $5a^4(2a^9 - 3a^{-4})$

4. $10b^{-20}(3b^{25} + 7b^{-21})$

5. $12a^{17}\left(\frac{1}{2a^{15}} + 3a^{-10}\right)$

6. $15b^{\frac{5}{2}}(2b^{\frac{1}{2}} + 5b^{-\frac{1}{2}})$

7. $a^{\frac{2}{5}}(4a + 10a^3)$

<p>Exercise 1</p> <p>1. Write the following numbers in scientific notation:</p> <p>a. 5,445,000 b. 6,543 c. 0.005417</p> <p>d. 140,200 e. 0.0000802 f. 20.353</p> <p>2. Write the following numbers in normal form:</p> <p>a. 5.32×10^5 b. 3.08×10^{-2} c. 7×10^{-3}</p> <p>d. 2.55×10^{11} e. 8.03×10^{-9} f. 3.3×10^3</p> <p>3. Calculate $(9.65 \times 10^6) \times (6.3 \times 10^{-2})$ giving your answer in normal form.</p> <p>4. Calculate $(6.45 \times 10^{11}) \times (1.25 \times 10^8)$ giving your answer in scientific notation.</p>	<p>Exercise 2</p> <p>1. Write the following numbers in scientific notation:</p> <p>a. 7,236,000 b. 6,645 c. 0.0003372</p> <p>d. 1,170,800 e. 0.000508 f. 13.381</p> <p>2. Write the following numbers in normal form:</p> <p>a. 4.24×10^4 b. 3.009×10^{-3} c. 6×10^{-6}</p> <p>d. 2.004×10^{10} e. 5.43×10^{-7} f. 3.2×10^7</p> <p>3. Calculate $(9.55 \times 10^7) \times (4.5 \times 10^{-3})$ giving your answer in normal form.</p> <p>4. Calculate $(7.34 \times 10^9) \times (8.05 \times 10^6)$ giving your answer in scientific notation.</p>
<p>Exercise 3</p> <p>1. Write the following numbers in scientific notation:</p> <p>a. 62,260 b. 8,554 c. 0.000064</p> <p>d. 140.8 e. 0.00109 f. 21.3</p> <p>2. Write the following numbers in normal form:</p> <p>a. 8.63×10^7 b. 4.25×10^{-3} c. 8×10^{-4}</p> <p>d. 1.005×10^{10} e. 1.953×10^{-6} f. 4.005×10^8</p> <p>3. Calculate $(7.57 \times 10^6) \times (5.5 \times 10^{-5})$ giving your answer in normal form.</p> <p>4. Calculate $(4.32 \times 10^5) \times (5.85 \times 10^5)$ giving your answer in scientific notation.</p>	<p>Exercise 4</p> <p>1. Write the following numbers in scientific notation:</p> <p>a. 27,900,000 b. 47,000 c. 0.0000065</p> <p>d. 133,300 e. 0.1201 f. 15.54</p> <p>2. Write the following numbers in normal form:</p> <p>a. 9.23×10^4 b. 5.3×10^{-3} c. 9.1×10^{-4}</p> <p>d. 4.505×10^6 e. 1.4301×10^{-5} f. 7.2×10^5</p> <p>3. Calculate $(5.22 \times 10^7) \times (4.5 \times 10^{-3})$ giving your answer in normal form.</p> <p>4. Calculate $(8.08 \times 10^6) \times (6.65 \times 10^7)$ giving your answer in scientific notation.</p>

E&F	Scientific Notation
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Exercise 1

1. Expand the brackets:

- | | |
|-------------------|------------------------|
| a. $5(3x - 3)$ | b. $6(2x + 4)$ |
| c. $8(2x - 2)$ | d. $2x(6x - 7)$ |
| e. $4x(8x + 8)$ | f. $5x(5x - 3y)$ |
| g. $-2x(2x - 2)$ | h. $-7(7 - 7x)$ |
| i. $-11(13y - x)$ | j. $-4x(5y - 4x + 2z)$ |

2. Expand the brackets and simplify where possible:

- | | |
|----------------------|----------------------|
| a. $3(7x + 3) + 13x$ | b. $5(2x + 15) - 20$ |
| c. $6 + 7(3x + 5)$ | d. $8x + 3(2x - 4)$ |

Exercise 2

1. Expand the brackets:

- | | |
|--------------------|-----------------------|
| a. $6(4x - 2)$ | b. $3(3x + 3)$ |
| c. $9(3x - 6)$ | d. $2x(6x - 6)$ |
| e. $4x(4x + 4)$ | f. $7x(4x - 2y)$ |
| g. $-2x(8x - 1)$ | h. $-3(6 - 6x)$ |
| i. $-13x(3y - 3x)$ | j. $-8x(3y - 3x - z)$ |

2. Expand the brackets and simplify where possible:

- | | |
|----------------------|----------------------|
| a. $4(5x + 3) - 12x$ | b. $3(2x + 5) + 15$ |
| c. $11 + 5(9x - 15)$ | d. $9x - 3(3x + 14)$ |

Exercise 3

1. Expand the brackets:

- | | |
|------------------|------------------------|
| a. $3(2x - 3)$ | b. $15(3x - 5)$ |
| c. $6(x - 4)$ | d. $2x(4x + 4)$ |
| e. $11x(x + 3)$ | f. $6x(7x - y)$ |
| g. $-3x(x - 13)$ | h. $-5(3 - 4x + y)$ |
| i. $-1x(4y + x)$ | j. $-7x(2y + 4x + 2z)$ |

2. Expand the brackets and simplify where possible:

- | | |
|---------------------|---------------------|
| a. $6(4x - 3) + 7x$ | b. $4(7x - 5) + 5$ |
| c. $7 + 2(2x - 15)$ | d. $6x - 3(2x - 6)$ |

Exercise 4

1. Expand the brackets:

- | | |
|--------------------|-----------------------|
| a. $5(2x - 12)$ | b. $5(4x + 9)$ |
| c. $6(6x - 6)$ | d. $4x(2x - 8)$ |
| e. $7x(7x + 8)$ | f. $7x(4x + 5y)$ |
| g. $-4x(5x - 3)$ | h. $-3(1 - 3x)$ |
| i. $-2x(13y - 2x)$ | j. $-8x(2y + 3x - z)$ |

2. Expand the brackets and simplify where possible:

- | | |
|----------------------|---------------------|
| a. $7(2x - 3) + 10x$ | b. $6(2x + 15) - 8$ |
| c. $9 + 5(2x + 15)$ | d. $3x - 4(2x - 4)$ |

Exercise 1

Expand the brackets and simplify your answer:

1. $(x + 4)(x + 2)$
2. $(x + 6)(x + 3)$
3. $(x + 1)(x - 6)$
4. $(x - 5)(x - 3)$
5. $(x - 5)(x - 5)$
6. $(x - 6)(x - 3)$
7. $(x - 8)(x + 2)$
8. $(x - 9)(x + 2)$
9. $3(x + 4)(x - 3)$

Exercise 2

Expand the brackets and simplify your answer:

1. $(x + 6)(x + 6)$
2. $(x + 2)(x + 3)$
3. $(x + 7)(x - 8)$
4. $(x + 4)(x - 7)$
5. $(x - 4)(x - 2)$
6. $(x - 3)(-x - 8)$
7. $2(x - 2)(x + 3)$
8. $3(x - 5)(2x + 1)$
9. $2(x - 3)(x + 2)$

Exercise 3

Expand the brackets and simplify your answer:

1. $(x + 4)(x + 1)$
2. $(x + 6)(x + 3)$
3. $(x + 2)(x - 2)$
4. $(x - 6)(x - 2)$
5. $(x + 4)(-x - 5)$
6. $(x - 3)(2x - 4) + 2x$
7. $2(x - 4)(3x + 1) - 5x$
8. $(2x + 5)(x - 13) + 6x$
9. $3(x + 1)(x - 3) - x + 1$

Exercise 4

Expand the brackets and simplify your answer:

1. $(x + 6)(x + 2)$
2. $(x + 7)(x + 3)$
3. $(x + 1)(x - 8)$
4. $(x + 5)(x - 9)$
5. $(x - 1)(4 - x)$
6. $(x - 6)(9 - x) - 6x$
7. $(5x - 6)(2x + 1) - 17$
8. $3(x - 5)(x + 5) - 3x$
9. $2(x - 5)(6 - 2x) + x - 3$

Exercise 1

1. Expand the brackets and simplify your answer:

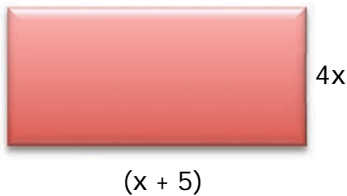
a. $(x + 4)(x^2 + 4x + 1)$

b. $(3x + 2)(x + 1)^2$

c. $(x^2 - 3x + 2)(x - 2)$

d. $(x + 3)^3$

2. Find an expression for the area of the rectangle:



Exercise 2

1. Expand the brackets and simplify your answer:

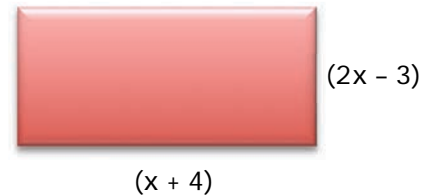
a. $(x + 4)(x^2 + 6x + 5)$

b. $(4x + 5)(x + 3)^2$

c. $(x^2 - 2x + 4)(x - 1)$

d. $(x + 2)^3$

2. Find an expression for the area of the rectangle:



Exercise 3

1. Expand the brackets and simplify your answer:

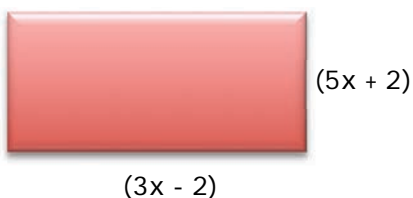
a. $(x - 5)(x^2 - 3x + 2)$

b. $(3x + 5)(x - 4)^2$

c. $(x^2 - 4x + 2)(x + 3)$

d. $(x - 5)^3$

2. Find an expression for the area of the rectangle:



Exercise 4

1. Expand the brackets and simplify your answer:

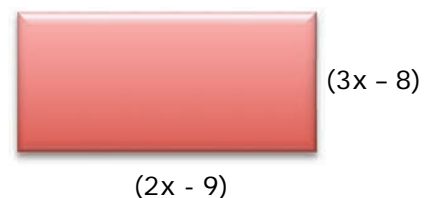
a. $(x + 3)(x^2 + 3x + 6)$

b. $(2x + 5)(x + 4)^2$

c. $(x^2 - 3x + 2)(x - 4)$

d. $(x - 4)^3$

2. Find an expression for the area of the rectangle:



Exercise 1

Factorise the following expressions:

1. $6x + 3$
2. $16x - 8$
3. $7x^2 - 21x$
4. $36x^3 - 12x$
5. $24x^2 - 8x$
6. $9yx^2 - 3xy$
7. $6x^2y^3 + 12xy + 6xy^2$
8. $18x^3yz^2 + 9xy^2z - 27xyz^2$

Exercise 2

Factorise the following expressions:

1. $5x + 15$
2. $12x - 2$
3. $6x^2 - 18x$
4. $60x^2 - 12x$
5. $15x^2 - 5x$
6. $7xy^3 + 56xy$
7. $13x^2y^2 + 26xy + 13x^2y$
8. $15x^2yz^3 + 5xy^2z - 25xyz$

Exercise 3

Factorise the following expressions:

1. $10x + 10$
2. $14x - 2$
3. $6x^2 - 24x$
4. $50x^2 - 25x$
5. $120x^2 + 12x$
6. $6y^2 - 2xy - 2y$
7. $44x^3y^3 + 4xy^2$
8. $16x^3yz^2 - 2xy^2z - 48xyz^2$

Exercise 4

Factorise the following expressions:

1. $6x + 3$
2. $20x - 2$
3. $8x^2 - 40x$
4. $32x^2 + 12x$
5. $150x^2 - 20x$
6. $6xy^2 + 4xy$
7. $14x^2y^2 - 7xy$
8. $20x^2yz^2 + 32xy^3z - 12xyz^2$

E&F

Factorising (common factor)

Exercise 1

Factorise the following expressions:

1. $x^2 - 25$
2. $x^2 - 16$
3. $x^2 - 9$
4. $2x^2 - 200$
5. $4x^2 - 16$
6. $5x^2 - 125$
7. $6x^2 - 96$
8. $10x^2 - 1000$

Exercise 2

Factorise the following expressions:

1. $x^2 - 36$
2. $x^2 - 64$
3. $x^2 - 81$
4. $2x^2 - 162$
5. $2x^2 - 50$
6. $3x^2 - 27$
7. $5x^2 - 180$
8. $8x^2 - 392$

Exercise 3

Factorise the following expressions:

1. $x^2 - 100$
2. $x^2 - 4$
3. $x^2 - 121$
4. $3x^2 - 12$
5. $4x^2 - 484$
6. $5x^2 - 45$
7. $2x^2 - 72$
8. $128 - 2x^2$

Exercise 4

Factorise the following expressions:

1. $x^2 - 400$
2. $x^2 - 169$
3. $3x^2 - 75$
4. $4x^2 - 144$
5. $4x^2 - 64$
6. $5x^2 - 405$
7. $6x^2 - 600$
8. $2000 - 5x^2$

E&F

Factorising (difference of two squares)

<p>Exercise 1</p> <p>Factorise:</p> <p>1. a. $x^2 + 5x + 6$ b. $x^2 + 2x + 1$ c. $x^2 + 4x + 4$ d. $x^2 + 7x + 12$</p> <p>2. a. $x^2 + x - 2$ b. $x^2 + 3x - 4$ d. $x^2 + x - 12$ d. $x^2 + x - 20$</p> <p>3. a. $x^2 - 2x - 3$ b. $x^2 - 3x - 4$ c. $x^2 - 17x - 18$ d. $x^2 - 8x - 9$</p> <p>4. a. $x^2 - 5x + 6$ b. $x^2 - 8x + 12$ c. $x^2 - 16x + 15$ d. $x^2 - 9x + 20$</p>	<p>Exercise 2</p> <p>Factorise:</p> <p>1. a. $x^2 + 7x + 6$ b. $x^2 + 3x + 2$ d. $x^2 + 5x + 4$ d. $x^2 + 8x + 12$</p> <p>2. a. $x^2 + 2x - 8$ b. $x^2 + 4x - 5$ c. $x^2 + 17x - 18$ d. $x^2 + 8x - 9$</p> <p>3. a. $x^2 - 4x - 5$ b. $x^2 - 6x - 7$ c. $x^2 - 5x - 14$ d. $x^2 - 3x - 10$</p> <p>4. a. $x^2 - 7x + 6$ b. $x^2 - 13x + 12$ c. $x^2 - 8x + 15$ d. $x^2 - 12x + 20$</p>
<p>Exercise 3</p> <p>Factorise:</p> <p>1. a. $x^2 + 4x + 3$ b. $x^2 + 6x + 5$ c. $x^2 + 8x + 15$ d. $x^2 + 11x + 18$</p> <p>2. a. $x^2 + 6x - 16$ b. $x^2 + 10x - 11$ c. $x^2 + 5x - 24$ d. $x^2 + 4x - 32$</p> <p>3. a. $x^2 - x - 12$ b. $x^2 - 15x - 16$ c. $x^2 - 5x - 24$ d. $x^2 - 5x - 36$</p> <p>4. a. $x^2 - 10x + 16$ b. $x^2 - 4x + 4$ c. $x^2 - 20x + 36$ d. $x^2 - 11x + 30$</p>	<p>Exercise 4</p> <p>Factorise:</p> <p>1. a. $x^2 + 13x + 22$ b. $x^2 + 19x + 18$ c. $x^2 + 19x + 60$ d. $x^2 + 17x + 72$</p> <p>2. a. $x^2 + 2x - 48$ b. $x^2 + 9x - 36$ c. $x^2 + 24x - 72$ d. $x^2 + 10x - 39$</p> <p>3. a. $x^2 - 3x - 54$ b. $x^2 - 18x - 63$ c. $x^2 - 8x - 48$ d. $x^2 - x - 132$</p> <p>4. a. $x^2 - 25x + 66$ b. $x^2 - 19x + 70$ c. $x^2 - 19x + 84$ d. $x^2 - 29x + 100$</p>

E&F	Factorising (trinomials)
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<p>Exercise 1</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $2x^2 + 3x + 1$2. $3x^2 + 7x + 2$3. $6x^2 + 13x + 6$4. $8x^2 + 22x + 5$5. $12x^2 + 17x + 6$6. $12x^2 + 20x + 3$7. $24x^2 + 38x + 15$	<p>Exercise 2</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $3x^2 - 2x - 1$2. $2x^2 + x - 3$3. $2x^2 - x - 10$4. $5x^2 - 3x - 2$5. $7x^2 + 18x - 9$6. $4x^2 - 5x - 6$7. $8x^2 - 19x - 10$
<p>Exercise 3</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $15x^2 + x - 2$2. $6x^2 - x - 12$3. $10x^2 + x - 2$4. $12x^2 - 13x - 4$5. $16x^2 - 3x - 15$6. $24x^2 - 31x - 15$7. $36x^2 - 19x - 6$	<p>Exercise 4</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $x^2 - 8x + 7$2. $x^2 - 8x + 15$3. $5x^2 - 34x + 24$4. $6x^2 - 23x + 20$5. $15x^2 - 33x + 6$6. $18x^2 - 45x + 28$7. $24x^2 - 46x + 15$

E&F	Factorising (trinomials)
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<p>Exercise 1</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $x^2 - 16$2. $3x^2 - 12$3. $2x^2 + 8x + 8$4. $16x^2 + 24x$5. $4x^2 + 12x + 8$6. $10x^2 - 25x - 15$7. $36x^2 - 69x + 30$	<p>Exercise 2</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $y^2 + 2y$2. $y^2 - 16$3. $5y^2 - 45$4. $y^2 + 4y - 12$5. $4y^2 - 9z^2$6. $12y^2 - 16y - 60$7. $48y^2 - 70y + 8$
<p>Exercise 3</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $m^2 - 100$2. $mn^2 - 2m^2n$3. $6m^2 - 54$4. $9m^2 - 64n^2$5. $m^2 - 6m - 16$6. $64m^3 + 32m^2 + 4m$7. $m^4 - 1$	<p>Exercise 4</p> <p>Factorise:</p> <ol style="list-style-type: none">1. $n^2 - 144$2. $5n^2 p^3 - 25np$3. $3n^2 - 12p^2$4. $3n^2 p^3 - 12n^2 p$5. $n^2 - 19n - 20$6. $4n^2 + 16n^2 + 15n$7. $4n^4 - 1$

E&F	Factorising (mixed)
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Exercise 1

Change each trinomial to the form $y = (x + a)^2 + b$:

1. $y = x^2 + 4x + 7$

2. $y = x^2 + 8x + 18$

3. $y = x^2 + 2x + 7$

4. $y = x^2 + 16x + 69$

5. $y = x^2 + 20x + 103$

6. $y = x^2 + 14x + 50$

Exercise 2

Change each trinomial to the form $y = (x \pm a)^2 + b$:

1. $y = x^2 - 10x + 27$

2. $y = x^2 - 4x + 12$

3. $y = x^2 - 6x + 18$

4. $y = x^2 - 14x + 53$

5. $y = x^2 - 22x + 123$

6. $y = x^2 - 24x + 145$

Exercise 3

Change each trinomial to the form $y = b - (x \pm a)^2$

1. $y = -x^2 - 2x + 3$

2. $y = -x^2 - 4x - 1$

3. $y = -x^2 + 2x + 4$

4. $y = -x^2 + 6x + 1$

5. $y = 7 - 2x - x^2$

6. $y = 8 + 4x - x^2$

Exercise 4

Change each trinomial to the form $y = (x \pm a)^2 + b$:

1. $y = x^2 + 12x + 43$

2. $y = x^2 - 10x + 19$

3. $y = x^2 - 8x + 18$

Change each trinomial to the form $y = b - (x \pm a)^2$

4. $y = -x^2 - 4x + 3$

5. $y = -x^2 + 8x + 6$

6. $y = -x^2 + 2x + 10$

Exercise 1

Simplify each of the following:

1. a. $\frac{3}{a} + \frac{4}{a}$ b. $\frac{5}{a} + \frac{6}{b}$ c. $\frac{9}{h} - \frac{7}{h^3}$

2. a. $\frac{3}{a} + \frac{5}{a+2}$ b. $\frac{2}{b-3} - \frac{5}{b}$

3. $\frac{8}{a+5} + \frac{1}{a-2}$

4. $\frac{3}{b^5} + \frac{7}{b^6}$

5. $\frac{2}{h+3} - \frac{7}{h+5}$

6. $\frac{a}{a+2} - \frac{4}{3a}$

Exercise 2

Simplify each of the following:

1. a. $\frac{6}{t} + \frac{7}{t}$ b. $\frac{7}{a} + \frac{2}{b}$ c. $\frac{10}{a^2} - \frac{9}{a^7}$

2. a. $\frac{4}{a} + \frac{3}{a+5}$ b. $\frac{1}{b-4} - \frac{6}{b}$

3. $\frac{2}{a+11} + \frac{3}{a-1}$

4. $\frac{9}{ab^3} + \frac{2}{b^2}$

5. $\frac{5}{h+1} - \frac{2}{h+9}$

6. $\frac{b}{b+3} - \frac{8}{5b}$

Exercise 3

Simplify each of the following:

1. a. $\frac{8}{y} + \frac{2}{y}$ b. $\frac{2}{p} + \frac{3}{t}$ c. $\frac{5}{m^2} - \frac{10}{m^{10}}$

2. a. $\frac{2}{a} + \frac{13}{a+5}$ b. $\frac{6}{b-1} - \frac{3}{b}$

3. $\frac{11}{a+2} + \frac{2}{a-2}$

4. $\frac{6}{b^8} + \frac{17}{b^{11}}$

5. $\frac{4}{h+5} - \frac{2}{h+2}$

6. $\frac{m}{m+1} - \frac{9}{8m}$

Exercise 4

Simplify each of the following:

1. a. $\frac{7}{f} + \frac{12}{f}$ b. $\frac{8}{x} + \frac{3}{y}$ c. $\frac{12}{b^7} - \frac{3}{b^{11}}$

2. a. $\frac{1}{a} + \frac{14}{a+4}$ b. $\frac{7}{b-2} - \frac{9}{b}$

3. $\frac{3}{a+7} + \frac{4}{a-5}$

4. $\frac{10}{b^9} + \frac{11}{b^{10}}$

5. $\frac{1}{h+9} - \frac{2}{h+6}$

6. $\frac{y}{y+2} - \frac{11}{10y}$

Exercise 1

Multiply or divide then simplify the following:

- a. $\frac{1}{3} \times \frac{2}{5}$ b. $\frac{6}{7} \times \frac{2}{18}$ c. $\frac{15}{24} \times \frac{12}{35}$
- a. $\frac{1}{4} \div \frac{3}{7}$ b. $\frac{3}{8} \div \frac{6}{16}$ c. $\frac{12}{14} \div \frac{36}{21}$
- a. $\frac{5}{2a} \times \frac{3a}{4}$ b. $\frac{6b}{10} \times \frac{5a}{12b}$ c. $\frac{10a^2}{6b^2} \times \frac{3b}{40}$
- a. $\frac{b}{2} \div \frac{b}{10}$ b. $\frac{5a}{9} \div \frac{10}{18a^2}$ c. $\frac{50a}{12b} \div \frac{10b}{24}$
- a. $\frac{20b^5}{a} \div \frac{25b^6}{2a}$ b. $\frac{2a^2b}{10} \times \frac{5}{4a^3b^2}$

Exercise 2

Multiply or divide then simplify the following:

- a. $\frac{2}{5} \times \frac{1}{7}$ b. $\frac{9}{10} \times \frac{2}{27}$ c. $\frac{20}{24} \times \frac{16}{30}$
- a. $\frac{1}{5} \div \frac{1}{3}$ b. $\frac{7}{12} \div \frac{14}{3}$ c. $\frac{24}{30} \div \frac{32}{40}$
- a. $\frac{2}{5a} \times \frac{3a}{6}$ b. $\frac{7b}{9} \times \frac{a}{14b}$ c. $\frac{3a^2}{7b^2} \times \frac{14b}{6}$
- a. $\frac{p}{14} \div \frac{p}{3}$ b. $\frac{7a}{11} \div \frac{21}{22a^3}$ c. $\frac{20a}{21b} \div \frac{30b}{42}$
- a. $\frac{10b^5}{2a} \div \frac{2b^4}{5a}$ b. $\frac{3a^2b^2}{8} \times \frac{2}{3ab^2}$

Exercise 3

Multiply or divide then simplify the following:

- a. $\frac{3}{8} \times \frac{3}{5}$ b. $\frac{3}{7} \times \frac{4}{15}$ c. $\frac{16}{21} \times \frac{14}{32}$
- a. $\frac{1}{8} \div \frac{2}{5}$ b. $\frac{8}{9} \div \frac{16}{18}$ c. $\frac{35}{50} \div \frac{40}{70}$
- a. $\frac{1}{4a} \times \frac{2a}{3}$ b. $\frac{2b}{13} \times \frac{2a}{6b}$ c. $\frac{8a^2}{6b^2} \times \frac{3b^3}{16}$
- a. $\frac{p}{14} \div \frac{p}{1}$ b. $\frac{3a}{12} \div \frac{6}{24a^2}$ c. $\frac{15a}{30b} \div \frac{45b}{50}$
- a. $\frac{6b^2}{3a} \div \frac{12b^6}{6a}$ b. $\frac{7ab^4}{9} \times \frac{3}{2a^3}$

Exercise 4

Multiply or divide then simplify the following:

- a. $\frac{2}{11} \times \frac{4}{10}$ b. $\frac{8}{9} \times \frac{3}{40}$ c. $\frac{50}{35} \times \frac{25}{100}$
- a. $\frac{1}{3} \div \frac{3}{11}$ b. $\frac{3}{4} \div \frac{9}{11}$ c. $\frac{60}{80} \div \frac{120}{200}$
- a. $\frac{5}{9a} \times \frac{11a}{2}$ b. $\frac{6b}{4} \times \frac{2a}{24b}$ c. $\frac{2a^2}{6b^6} \times \frac{12b^5}{4}$
- a. $\frac{m}{13} \div \frac{m}{2}$ b. $\frac{2a}{7} \div \frac{8}{28a^4}$ c. $\frac{13a}{20b} \div \frac{26b}{40}$
- a. $\frac{11b^5}{5a} \div \frac{22b^6}{20a}$ b. $\frac{10a}{13} \times \frac{5a}{20a^4b^4}$

Exercise 1

Simplify each of the following:

1. a. $\frac{12a^5}{2a}$ b. $\frac{a^4b^6}{a^2b}$ c. $\frac{(a+9)^7}{(a+9)^3}$
- d. $\frac{(b^6+8)^9}{(b^6+8)^3}$ e. $\frac{(b^4+2)^2}{(b^4+2)^5}$

Factorise the following, then simplify:

2. $\frac{5}{5a-20}$
3. $\frac{b+4}{b^2-16}$
4. $\frac{a^2+6a}{a^2+8a+12}$
5. $\frac{b^2+4b+4}{b^2-3b-10}$

Exercise 2

Simplify each of the following:

1. a. $\frac{10a^3}{2a^2}$ b. $\frac{a^5b^4}{a^6b^2}$ c. $\frac{(a-4)^8}{(a-4)^{-2}}$
- d. $\frac{(b^7-1)^6}{(b^7-1)^2}$ e. $\frac{(b^{11}+2b)^2}{(b^{11}+2b)^7}$

Factorise the following, then simplify:

2. $\frac{2}{12a-16}$
3. $\frac{b-3}{b^2-9}$
4. $\frac{a^2-5a}{a^2-8a+15}$
5. $\frac{b^2+5b+6}{b^2+13b+30}$

Exercise 3

Simplify each of the following:

1. a. $\frac{24a^{10}}{8a^3}$ b. $\frac{ab^2}{a^2b^{-5}}$ c. $\frac{(a-18)^{11}}{(a-18)^2}$
- d. $\frac{(3b^3+5)^8}{(3b^3+5)^2}$ e. $\frac{(b^7+2)^3}{(b^7+2)^{12}}$

Factorise the following, then simplify:

2. $\frac{7}{35a-14}$
3. $\frac{b+2}{b^2-4}$
4. $\frac{a^2+10a}{a^2+8a-20}$
5. $\frac{b^2+3b+2}{b^2-4b-5}$

Exercise 4

Simplify each of the following:

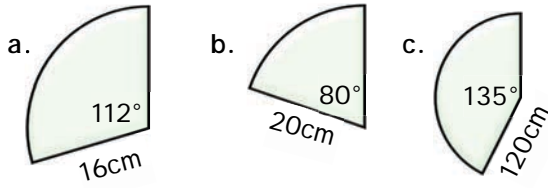
1. a. $\frac{30a^6}{10a}$ b. $\frac{a^{15}b^3}{a^2b^{-4}}$ c. $\frac{(a+15)^{20}}{(a+15)^{15}}$
- d. $\frac{(5b^6+17)^4}{(5b^6+17)^2}$ e. $\frac{(b^3-14)^3}{(b^3-14)^9}$

Factorise the following, then simplify:

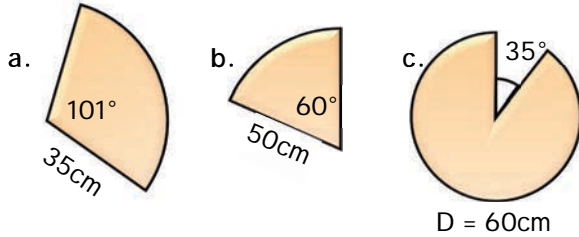
2. $\frac{10}{15a-40}$
3. $\frac{b-7}{b^2-49}$
4. $\frac{a^2+7a}{a^2+4a-21}$
5. $\frac{b^2+12b+27}{b^2-3b-18}$

Exercise 1

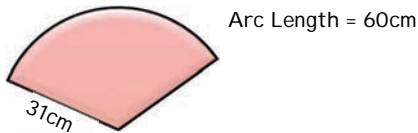
1. Find the length of the following arcs:



2. Find the area of the following sectors:

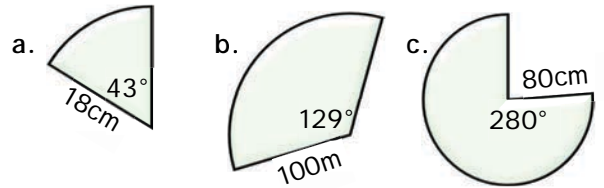


3. Find the angle at the centre of the sector:

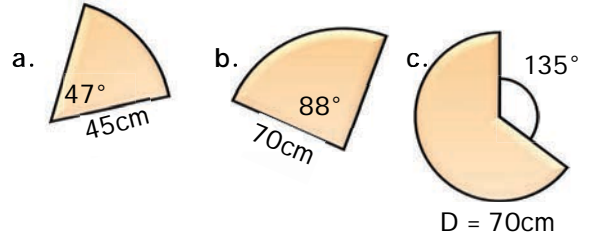


Exercise 2

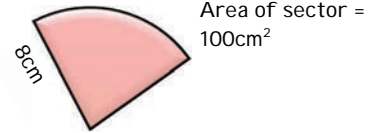
1. Find the length of the following arcs:



2. Find the area of the following sectors:

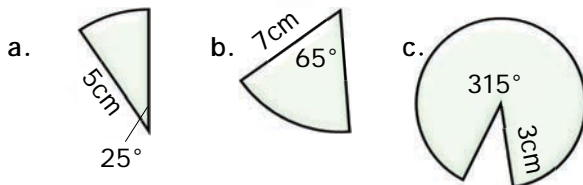


3. Find the angle at the centre of the

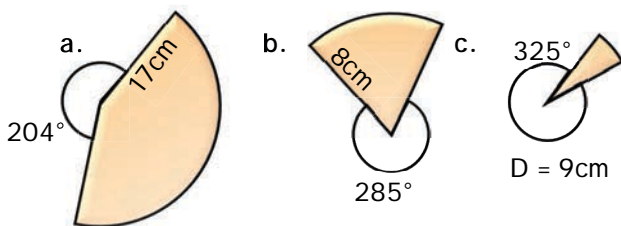


Exercise 3

1. Find the length of the following arcs:



2. Find the area of the following sectors:

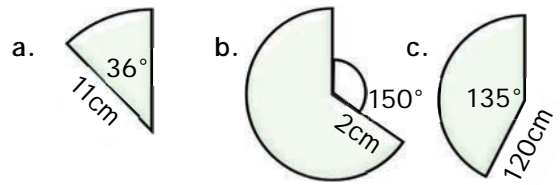


3. Find the angle at the centre of the

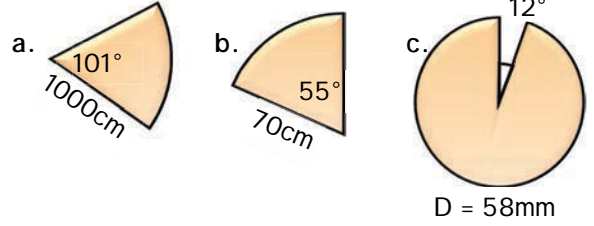


Exercise 4

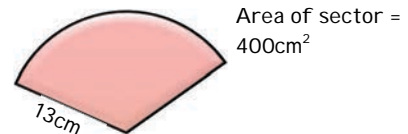
1. Find the length of the following arcs:



2. Find the area of the following sectors:



3. Find the angle at the centre of the



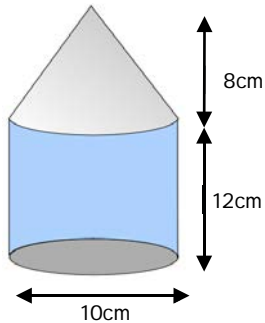
E&F	Length of Arc, Area of Sector
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<p>Exercise 1</p> <ol style="list-style-type: none">1. Find the volume of a sphere with diameter 16cm; give your answer to 2 significant figures.2. Find the volume of cone with height 8cm and radius 4cm; give your answer to 2 significant figures.3. Find the volume of a cylinder of height 5cm and diameter 8cm give your answer to 2 significant figures.4. Find the height of cylinder with volume 600cm^3 and radius 9cm.5. Find the radius of a hemisphere of volume 2000cm^3.	<p>Exercise 2</p> <ol style="list-style-type: none">1. Find the volume of a sphere with diameter 25cm; give your answer to 2 significant figures.2. Find the volume of cone with height 20cm and radius 5cm; give your answer to 2 significant figures.3. Find the volume of a cylinder of height 120cm and diameter 40cm; give your answer to 2 significant figures.4. Find the height of cylinder with volume 1200cm^3 and radius 12cm.5. Find the radius of a hemisphere of volume 16000cm^3.
<p>Exercise 3</p> <ol style="list-style-type: none">1. Find the volume of a sphere with diameter 60cm; give your answer to 2 significant figures.2. Find the volume of cone with height 250cm and radius 60cm; give your answer to 2 significant figures.3. Find the volume of a cylinder of height 18cm and diameter 3cm give your answer to 2 significant figures.4. Find the height of cylinder with volume 16cm^3 and radius 3cm.5. Find the radius of a hemisphere of volume 250cm^3.	<p>Exercise 4</p> <ol style="list-style-type: none">1. Find the volume of a sphere with diameter 16cm; give your answer to 2 significant figures.2. Find the volume of cone with height 8cm and radius 4 cm; give your answer to 2 significant figures.3. Find the volume of a cylinder of height 5cm and diameter 8cm give your answer to 2 significant figures.4. Find the height of cylinder with volume 260cm^3 and radius 7cm.5. Find the radius of a hemisphere of volume 56cm^3.

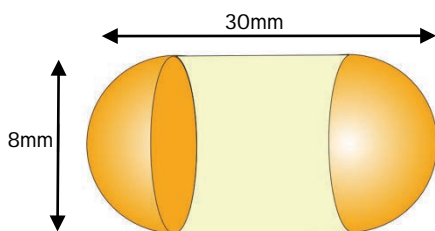
E&F	Volumes
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Exercise 1

1. Find the volume of the given shape to two significant figures:

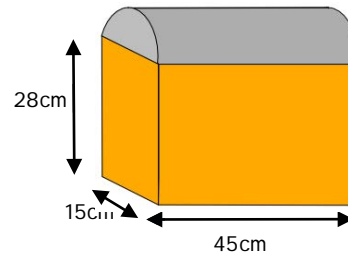


2. Find the volume of the given shape to two significant figures:

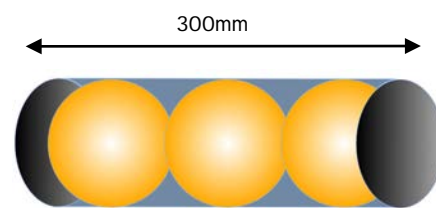


Exercise 2

1. Find the volume of the given shape to two significant figures:

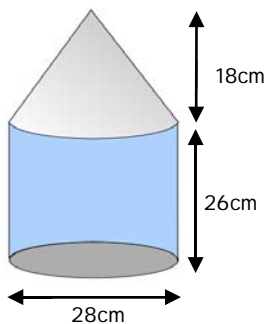


2. Three balls fit end to end exactly into a cylindrical tube, calculate the volume of empty space in the tube to two significant figures:

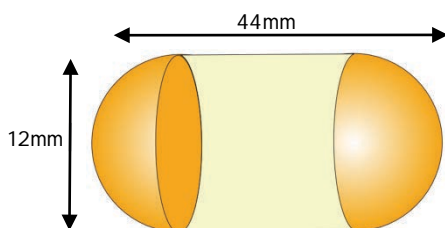


Exercise 3

1. Find the volume of a the given shape to two significant figures:

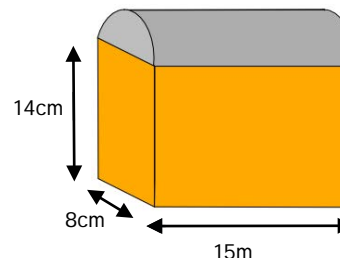


2. Find the volume of the given shape to two significant figures:

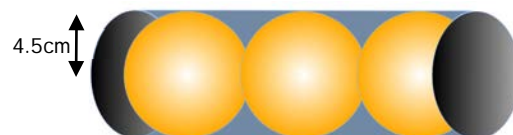


Exercise 4

1. Find the volume of the given shape to two significant figures:



2. Three balls fit end to end exactly into a cylindrical tube, calculate the volume of empty space in the tube to two significant figures:

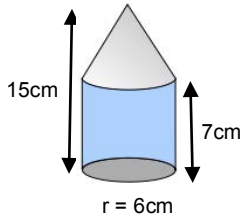


Exercise 1

1. Find the gradient of line passing through the points (2, 5) and (10, 29).

2. Simplify: (a) $\frac{x^2 - 4}{x^2 - x - 2}$ (b) $\frac{x}{x-1} + \frac{2}{x+2}$

3. Find the volume of the shape.

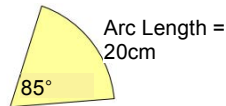


4. Simplify:

(a) $\sqrt{32} + \sqrt{8}$

(b) $\frac{x^2 \times x^4}{x^3}$

5. Find the radius

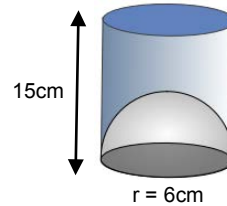


Exercise 2

1. Find the gradient of line passing through the points (-2, 5) and (10, -31).

2. Simplify: (a) $\frac{x^2 - 2x}{x^2 + 2x - 8}$ (b) $\frac{x}{x-1} - \frac{2}{x-2}$

3. Find the volume of the shape.



4. Simplify:

(a) $4\sqrt{50} + 3\sqrt{8}$

(b) $\frac{x^5 \times x^7}{x^3}$

5. Find the radius

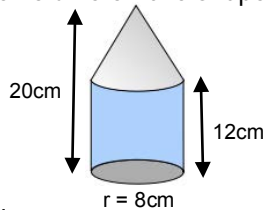


Exercise 3

1. Find the gradient of line passing through the points (12, 4) and (-2, 32).

2. Simplify: (a) $\frac{x^2 - x - 6}{x^2 - 9}$ (b) $\frac{x}{x-2} + \frac{3}{x-4}$

3. Find the volume of the shape.

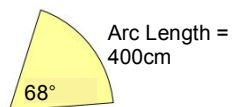


4. Simplify:

(a) $5\sqrt{72} - 5\sqrt{18}$

(b) $\frac{x^9 \times x^3}{x^5}$

5. Find the radius

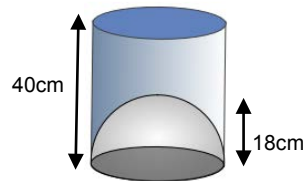


Exercise 4

1. Find the gradient of line passing through the points (8, 4) and (10, 20).

2. Simplify: (a) $\frac{4x^2 - 16}{x^2 + 2x - 8}$ (b) $\frac{3x}{x-1} - \frac{2x}{x-5}$

3. Find the volume of the shape.

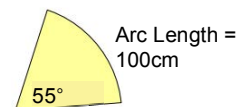


4. Simplify:

(a) $6\sqrt{200} - 12\sqrt{50}$

(b) $\frac{x^8 \times x^9}{x^{10}}$

5. Find the radius



E&F

Mixed Review

Exercise 1

1. Multiply out the brackets and simplify:

a. $(x + 2)(x^2 - 2x + 3)$ b. $3x(x - 2) - 2(x^2 - 4)$

2. Factorise: a. $3x^2 - 75$ b. $2x^2 - 9x - 5$

3. Find the angle of the sector below:



4. Rationalise the denominator:

a. $\frac{2}{\sqrt{7}}$ b. $\frac{3}{2\sqrt{3}}$

5. Simplify: a. $\frac{3a^3}{7b^4} \times \frac{21b}{9a^2}$ b. $\frac{15t^2r}{8} \div \frac{5t^3}{r^4}$

Exercise 2

1. Multiply out the brackets and simplify:

a. $(x - 1)(x^2 - 5x + 2)$ b. $7x^2(3x - 1) - 8(x^2 - 9)$

2. Factorise: a. $2x^2 - 18$ b. $3x^2 - 5x - 2$

3. Find the angle of the sector below:



4. Rationalise the denominator:

a. $\frac{4}{\sqrt{3}}$ b. $\frac{7}{5\sqrt{2}}$

5. Simplify: a. $\frac{10a^2}{26b^4} \times \frac{13b}{15a^4}$ b. $\frac{24t^3r^2}{5} \div \frac{16t}{r^3}$

Exercise 3

1. Multiply out the brackets and simplify:

a. $(x + 1)(2x^2 - 5x + 1)$ b. $2x(x - 1) - 3(x^2 - 5)$

2. Factorise: a. $5x^2 - 125$ b. $5x^2 - 4x - 1$

3. Find the angle of the sector below:



4. Rationalise the denominator:

a. $\frac{6}{\sqrt{11}}$ b. $\frac{10}{3\sqrt{5}}$

5. Simplify: a. $\frac{12a^4}{14b^3} \times \frac{7b}{24a^2}$ b. $\frac{18tr^2}{3} \div \frac{12t^3}{9r}$

Exercise 4

1. Multiply out the brackets and simplify:

a. $(x - 2)(3x^2 - x - 1)$ b. $9x(x - 3) - 7(x^2 - 1)$

2. Factorise: a. $6x^2 - 24$ b. $2x^2 - 3x + 1$

3. Find the angle of the sector below:



4. Rationalise the denominator:

a. $\frac{8}{\sqrt{13}}$ b. $\frac{2}{5\sqrt{7}}$

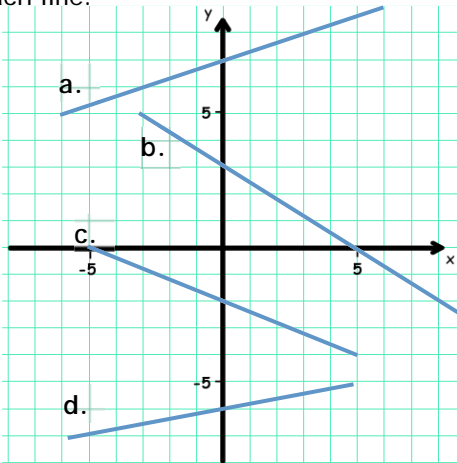
5. Simplify: a. $\frac{8a^7}{40b^2} \times \frac{20b}{16a^2}$ b. $\frac{5t^2}{7} \div \frac{50t^8}{r^2}$

E&F

Mixed Review

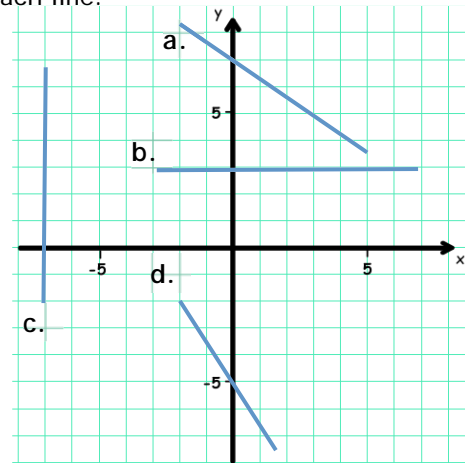
Exercise 1

- Calculate the gradient of the line joining the two points:
 - $(0, -11), (6, -5)$
 - $(9, -30), (19, -40)$
 - $(6, -2), (-6, -1)$
 - $(-5, -3), (2, 2)$
- From the diagram determine the equation of each line:



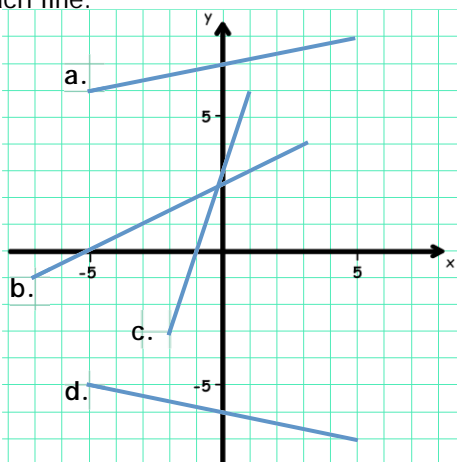
Exercise 2

- Calculate the gradient of the line joining the two points:
 - $(-4, -5), (-5, -5)$
 - $(9, 0), (5, -4)$
 - $(0, 0), (5, -8)$
 - $(-6, 3), (-12, 7)$
- From the diagram determine the equation of each line:



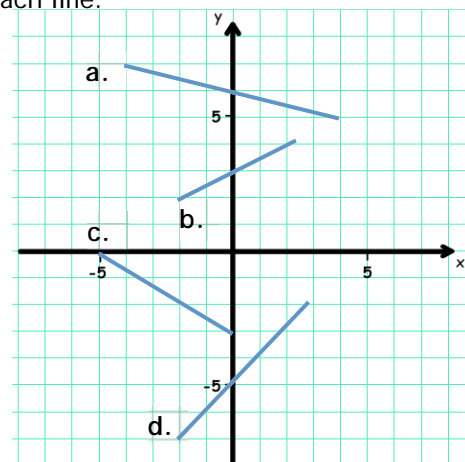
Exercise 3

- Calculate the gradient of the line joining the two points:
 - $(4, -3), (6, -5)$
 - $(2, 4), (7, 14)$
 - $(3, 4), (5, -6)$
 - $(-8, 5), (-2, 2)$
- From the diagram determine the equation of each line:



Exercise 4

- Calculate the gradient of the line joining the two points:
 - $(4, -13), (6, -5)$
 - $(1, 4), (7, 12)$
 - $(6, 9), (5, -6)$
 - $(-8, -3), (-2, -2)$
- From the diagram determine the equation of each line:



Exercise 1

- Determine the equation of the line joining the following two points:
 - $(6, 10), (4, 8)$
 - $(-2, -3), (-5, -12)$
 - $(3, -3), (-2, 7)$
 - $(-4, -1), (12, 7)$
- On a suitable set of axes, draw the lines of the following equations:
 - $y = 2x + 3$
 - $y = 5x + 5$
 - $y = -\frac{5}{2}x + 4$
 - $y = 3 + 3x$

Exercise 2

- Determine the equation of the line joining the following two points:
 - $(5, 5), (10, 10)$
 - $(3, -2), (5, -11)$
 - $(6, 3), (4, 4)$
 - $(4, -2), (6, 3)$
- On a suitable set of axes, draw the lines of the following equations:
 - $y = 4x - 6$
 - $y = x + 5$
 - $y = \frac{1}{4}x + 4$
 - $y = -3 + 2x$

Exercise 3

- Determine the equation of the line joining the following two points:
 - $(3, 7), (3, 5)$
 - $(3, -3), (7, -5)$
 - $(-7, 11), (-5, 9)$
 - $(-10, -4), (-3, 3)$
- On a suitable set of axes, draw the lines of the following equations:
 - $y = x + 6$
 - $y = -2x - 1$
 - $y = -\frac{1}{3}x - 3$
 - $y = 5 - 3x$

Exercise 4

- Determine the equation of the line joining the following two points:
 - $(3, 9), (4, 6)$
 - $(5, -8), (7, -12)$
 - $(-3, 4), (5, 14)$
 - $(-8, -9), (-4, -6)$
- On a suitable set of axes, draw the lines of the following equations:
 - $y = 6x + 3$
 - $y = 2x - 3$
 - $y = \frac{1}{2}x - 4$
 - $y = -2 - x$

Relationships

Equation of lines, drawing lines

Exercise 1

- Determine the gradient and y-intercept of the following lines:
 - $y = 6x + 13$
 - $3y = -6x + 1$
 - $9y + 12 = 3x$
 - $4x - 8y + 2 = 0$
- Sketch a line that satisfies the conditions $m > 0$ and $c < 0$
- Find the equation of the following lines:
 - Gradient 4, passing through (3, 7)
 - Gradient $-\frac{5}{2}$, passing through (8, 1)

Exercise 2

- Determine the gradient and y-intercept of the following lines:
 - $y = 8x - 20$
 - $6y = 2x + 4$
 - $5y - 15 = 5x$
 - $6x + 24y - 4 = 0$
- Sketch a line that satisfies the conditions $m < 0$ and $c < 0$
- Find the equation of the following lines:
 - Gradient 0, passing through (2, 4)
 - Gradient $-\frac{1}{2}$, passing through (-3, -1)

Exercise 3

- Determine the gradient and y-intercept of the following lines:
 - $y = 9x - 9$
 - $3y = 9x - 4$
 - $3y - 12 = 3x$
 - $8x + 8y - 16 = 0$
- Sketch a line that satisfies the conditions $m < 0$ and $c > 0$
- Find the equation of the following lines:
 - Gradient 4, passing through (0, 1)
 - Gradient -0.25, passing through (10, 15)

Exercise 4

- Determine the gradient and y-intercept of the following lines:
 - $y = 4x + 4$
 - $2y = 5x + 10$
 - $-3y + 2 = 3x$
 - $3x - 6y + 1 = 0$
- Sketch a line that satisfies the conditions $m = 0$ and $c < 0$
- Find the equation of the following lines:
 - Gradient 6, passing through (2, 8)
 - Gradient 0.5, passing through (3, 6)

Exercise 1

Solve the following equations:

1. $4(x - 2) = 3(x + 3)$
2. $5(x + 2) = 2(x - 2)$
3. $6(x - 4) = 3(x + 1)$
4. $3(x + 2) + 4 = 2(x + 3)$
5. $4(x - 2) - 5 = 2 + 3(x + 3)$
6. $4(2x - 2) - 8 = 3(x - 4)$

Exercise 2

Solve the following equations:

1. $5(x + 4) = 3(x + 5)$
2. $5(2x - 3) = 2(3x + 2)$
3. $3(2x - 6) = 6(3x + 2)$
4. $2(2x + 6) + 4 = 2(5x + 4)$
5. $4(2x - 6) - 5 = 2 - 3(2x + 3)$
6. $6(2x - 3) = 4 - 5(x - 5)$

Exercise 3

Solve the following equations:

1. $7(x + 4) = 5x + 2$
2. $5x - 10 = 8(x - 2)$
3. $7(x - 4) = 6(x + 1)$
4. $4(2x + 2) - 10 = 5(2x + 3)$
5. $5(x - 2) - 5 = 8 - 3(2x + 7)$
6. $4(8x - 2) - 8 = 3(7x - 4) - 20$

Exercise 4

Solve the following equations:

1. $3(x + 3) = 8(x + 10)$
2. $6(3x - 2) = 5(2x + 6)$
3. $9(2x - 12) = 6(6x + 9)$
4. $3(2x - 5) - 12 = 2(8x + 4)$
5. $9(3x - 5) + 14 = 2 - 5(5x + 3)$
6. $7(2x + 12) = 4 - 10(x - 5)$

Exercise 1

Solve the following equations:

1. $\frac{1}{2}(x - 12) = 4(x - 8)$

2. $\frac{1}{4}(x - 3) = \frac{1}{2}(x - 2)$

3. $\frac{1}{3}(2x - 3) = \frac{1}{6}(x - 2)$

4. $\frac{1}{4}(x - 5) = \frac{1}{8}(x - 2)$

5. $\frac{1}{3}(x + 12) = \frac{1}{4}(x - 2)$

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

Exercise 2

Solve the following equations:

1. $\frac{1}{3}(x - 9) = 5(x - 3)$

2. $\frac{1}{4}(x + 2) = \frac{1}{2}(x - 4)$

3. $\frac{1}{3}(4x - 4) = \frac{1}{6}(x - 3)$

4. $\frac{1}{4}(x - 5) = \frac{1}{12}(2x - 12)$

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

6. $\frac{3}{4}(x - 6) = \frac{2}{5}(x - 5)$

Exercise 3

Solve the following equations:

1. $\frac{1}{5}(2x - 12) = \frac{1}{5}(x - 5)$

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

3. $\frac{1}{3}(2x - 3) = \frac{2}{7}(2x - 5)$

4. $\frac{3}{4}(x - 2) = \frac{1}{3}(x - 2)$

5. $\frac{(x + 12)}{3} = \frac{(x - 2)}{4}$

6. $\frac{(x - 3)}{5} = \frac{(x - 2)}{4}$

Exercise 4

Solve the following equations:

1. $\frac{1}{8}(x - 13) = 4(x - 8)$

2. $\frac{1}{4}(x - 5) = \frac{1}{5}(x - 3)$

3. $\frac{3}{4}(5x - 3) = \frac{5}{6}(x - 2)$

4. $\frac{3}{4}(x - 4) = \frac{5}{8}(x - 2)$

5. $\frac{(x + 9)}{3} = \frac{(x + 5)}{7}$

6. $\frac{(x + 10)}{4} = \frac{(x + 8)}{9}$

Exercise 1

Solve the following inequations:

1. $5x + 1 < 26$
2. $2x + 6 > 30$
3. $4x + 3 \leq 23$
4. $8x - 2 \geq 38$
5. $4(2x + 3) < 28$
6. $\frac{1}{2}x + 6 > 14$
7. $5(2x - 1) \leq 2x + 19$
8. $7x + 5 > 4(5x - 2)$

Exercise 2

Solve the following inequations:

1. $6x + 2 < 32$
2. $7x + 8 > 50$
3. $3x + 2 \leq 25$
4. $9x - 4 \geq 32$
5. $6(5x + 3) < 48$
6. $\frac{1}{3}x + 3 > 33$
7. $6(2x - 2) \leq 2x + 8$
8. $5x + 6 > 4(3x - 2)$

Exercise 3

Solve the following inequations:

1. $3x + 9 < 27$
2. $2x + 10 > 40$
3. $8x + 5 \leq 45$
4. $10x - 5 \geq 60$
5. $7(2x + 3) < 63$
6. $\frac{1}{4}x + 2 > 20$
7. $8(x - 2) \leq 2x + 18$
8. $x + 4 > 2(x - 2)$

Exercise 4

Solve the following inequations:

1. $8x + 7 < 71$
2. $16x + 2 > 34$
3. $4x + 1 \leq 17$
4. $20x - 20 \geq 100$
5. $9(x + 5) < 72$
6. $\frac{1}{5}x + 6 > 8$
7. $3(2x - 2) \leq 2x + 5$
8. $x + 7 > 2(x - 2)$

Exercise 1

Solve the following equations:

- $3a + 3b = -3$
 $4a - b = 11$
- $5a - 3b = -7$
 $3a + b = 7$
- $4a - 3b = 22$
 $5a + 2b = 16$
- $6a + 4b = 2$
 $3a - 2b = -19$
- $3a + 0.5b = 25$
 $2a - 4b = 8$
- $2a + 2b = 7$
 $6a - 5b = -12$

Exercise 2

Solve the following equations:

- $3c + d = 1$
 $4c - 3d = 10$
- $5c - 3d = -2$
 $3c + d = -4$
- $3c - 3d = 18$
 $5c + 2d = 16$
- $6c + 4d = -34$
 $3c - 2d = -13$
- $3c + 0.5d = 4$
 $2c - 4d = -6$
- $2c + 2d = 3$
 $6c - 5d = -2$

Exercise 3

Solve the following equations:

- $3e + 3f = -6$
 $4e - f = -3$
- $5e - 3f = -1$
 $3e + f = -9$
- $4e - 3f = -11$
 $5e + 2f = -8$
- $6e + 4f = -22$
 $3e - 2f = -7$
- $3e + 0.5f = 3.5$
 $2e - 4f = -2$
- $2e + 2f = -4$
 $6e - 5f = -1$

Exercise 4

Solve the following equations:

- $3g + 3h = 3$
 $4g - h = 9$
- $5g - 3h = 9$
 $3g + h = -3$
- $4g - 3h = 2$
 $5g + 2h = 14$
- $6g + 4h = 6$
 $3g - 2h = 27$
- $3g + 0.5h = 9$
 $2g - 4h = 32$
- $2g + 2h = 22$
 $6g - 5h = -44$

Relationships

Simultaneous Equations

<p>Exercise 1</p> <p>1. Three pencils and two rubbers cost £0.95, four pencils and five rubbers cost £1.85.</p> <p>By forming two equations, calculate how much one pencil and one rubber costs.</p> <p>2. The local cinema has standard and superior seats. On Thursday they sell 50 standard and 5 superior seats for the X-Men and tickets sales amount to £366. On Friday they sell 100 standard and 20 superior seats and ticket sales amount to £814.</p> <p>By forming two equations, calculate how much 1 standard and 1 superior seat cost.</p>	<p>Exercise 2</p> <p>1. A plane seats 180 passengers. A standard class ticket costs £120 and a business class ticket costs £250. If the plane is full, the ticket sales are £27,450.</p> <p>By forming two equations, calculate how many standard and business class tickets there are.</p> <p>2. James has a pay-as-you-go phone. One day he sends 30 text messages and uses 45 minutes and it costs him £9.45. Another day he sends 25 text messages and uses 9 minutes and it costs him £4.17.</p> <p>By forming two equations, calculate how much 1 text message and 1 minute costs.</p>
<p>Exercise 3</p> <p>1. Five pencils and three rubbers cost £1.90, four pencils and five rubbers cost £2.30.</p> <p>By forming two equations, calculate how much one pencil and one rubber costs.</p> <p>2. The local cinema has standard and superior seats. On Thursday they sell 25 standard and 8 superior seats for the X-Men and tickets sales amount to £238. On Friday they sell 150 standard and 32 superior seats and ticket sales amount to £1292.</p> <p>By forming two equations, calculate how much 1 standard and 1 superior 1 minute costs.</p>	<p>Exercise 4</p> <p>1. A plane seats 200 passengers. A standard class ticket costs £150 and a business class ticket costs £250. If the plane is full, the ticket sales are £38,000.</p> <p>By forming two equations, calculate how many standard and business class tickets there are.</p> <p>2. James has a pay-as-you-go phone. One day he sends 100 text messages and uses 5 minutes and it costs him £8.50. Another day he sends 25 text messages and uses 20 minutes and it costs him £4.</p> <p>By forming two equations, calculate how much 1 text message and 1 minute costs.</p>

Relationships	Simultaneous Equations
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Exercise 1

1. By sketching the following lines on a suitable set of axes, solve the following equations:

a. $y = 2x - 1$
 $2x + y = 11$

b. $y = 3x - 11$
 $x + 2y = 13$

c. $y = -3x + 4$
 $5x + y = 2$

d. $y = -2x + 5$
 $2x + 4y = 2$

2. Solve the following algebraically:

$$\begin{aligned} 2x + 3y &= -1 \\ 5x - 5y &= 35 \end{aligned}$$

Exercise 2

1. By sketching the following lines on a suitable set of axes, solve the following equations:

a. $y = 3x - 4$
 $2x + y = -14$

b. $y = 5x - 1$
 $x + y = 17$

c. $y = -6x - 6$
 $9x - y = -24$

d. $y = -3x - 2$
 $x + 4y = 10$

2. Solve the following algebraically:

$$\begin{aligned} 3x + 3y &= -9 \\ 5x - 5y &= 5 \end{aligned}$$

Exercise 3

1. By sketching the following lines on a suitable set of axes, solve the following equations:

a. $y = 4x - 2$
 $x - 3y = -16$

b. $y = 4x - 10$
 $5x - y = 9$

c. $y = -5x + 15$
 $-x + 0.5y = 18$

d. $y = -8x + 19$
 $4x + 4y = 20$

2. Solve the following algebraically:

$$\begin{aligned} 5x - 5y &= 5 \\ 7x - 2y &= 17 \end{aligned}$$

Exercise 4

1. By sketching the following lines on a suitable set of axes, solve the following equations:

a. $y = 2x - 6$
 $6x - y = -6$

b. $y = -5x - 11$
 $-x + 3y = -17$

c. $y = 7x - 7$
 $5x - y = 1$

d. $y = -8x - 32$
 $3x + 0.25y = -10$

2. Solve the following algebraically:

$$\begin{aligned} 4x + 7y &= 6 \\ 3x - 8y &= 31 \end{aligned}$$

Relationships

Equation of lines, drawing lines

<p>Exercise 1</p> <p>Change the subject of the formula:</p> <ol style="list-style-type: none"> $m = pq + b$ [p] $a = \frac{rp}{c}$ [p] $V = \pi r^2 h$ [r] $C = \sqrt{t - 5}$ [t] $s = \sqrt{\frac{a}{\pi b}}$ [a] $V = \frac{1}{3} \pi r^2 h$ [h] 	<p>Exercise 2</p> <p>Change the subject of the formula:</p> <ol style="list-style-type: none"> $d = ab + c$ [b] $e = \frac{fg}{w}$ [g] $T = \pi r^2 w$ [r] $Z = \sqrt{4 + 2x}$ [x] $p = \sqrt{\frac{a}{\pi c}}$ [c] $V = \frac{1}{3} \pi r^2 h$ [r]
<p>Exercise 3</p> <p>Change the subject of the formula:</p> <ol style="list-style-type: none"> $p = k - mn$ [n] $b = \frac{4dw}{a}$ [d] $y = 5d^2s$ [d] $Sector = \frac{x}{360} \times \pi r^2$ [x] $s = \sqrt{\frac{a}{\pi b}}$ [b] $V = \frac{4}{3} \pi r^3$ [r] 	<p>Exercise 4</p> <p>Change the subject of the formula:</p> <ol style="list-style-type: none"> $e = tq - r$ [r] $t = \frac{sr}{w}$ [s] $C = \pi a^2 b$ [a] $T = \sqrt{9 - 3x}$ [x] $c = 2 + \sqrt{\frac{a}{\pi b}}$ [a] $Area = \frac{x}{360} \times \pi D$ [x]

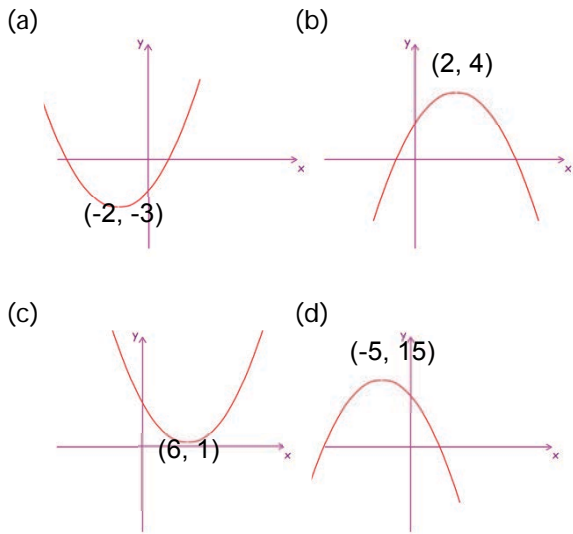
Relationships	Change the Subject
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<p>Exercise 1</p> <p>Change the subject of the formula:</p> <p>1. $y = 2r + c$ [r]</p> <p>2. $u = \frac{nf}{w}$ [n]</p> <p>3. $V = \frac{4}{3}\pi r^3$ [r]</p> <p>4. $w = \sqrt{c - 6}$ [c]</p> <p>5. $s = \sqrt{\frac{m}{\pi b}}$ [m]</p> <p>6. $V = \frac{1}{3}\pi r^2 h$ [r]</p>	<p>Exercise 2</p> <p>Change the subject of the formula:</p> <p>1. $6 = 2a + c$ [c]</p> <p>2. $k = \frac{5g}{w}$ [w]</p> <p>3. $\pi = \frac{r^2}{2q}$ [q]</p> <p>4. $Z = \sqrt{4r + 2x}$ [r]</p> <p>5. $y = \sqrt{\frac{4}{\pi c}}$ [c]</p> <p>6. $V = \frac{1}{3}bh$ [b]</p>
<p>Exercise 3</p> <p>Change the subject of the formula:</p> <p>1. $m = nw - r$ [n]</p> <p>2. $b = \frac{6dw}{13}$ [d]</p> <p>3. $j = 15d^2s$ [d]</p> <p>4. $S = \frac{m}{360} \times \pi r^2$ [m]</p> <p>5. $v = \sqrt{\frac{n}{\pi k}}$ [n]</p> <p>6. $V = \frac{4}{3}\pi(m + n)^3$ [n]</p>	<p>Exercise 4</p> <p>Change the subject of the formula:</p> <p>1. $y = tq - 5$ [q]</p> <p>2. $(t + j) = \frac{2r}{w}$ [w]</p> <p>3. $k = \pi a^2 p$ [a]</p> <p>4. $h = \sqrt{9 - 4x}$ [x]</p> <p>5. $d = 5 + \sqrt{\frac{a}{\pi e}}$ [a]</p> <p>6. $A = \frac{y}{360} \times \pi f$ [f]</p>

Relationships	Change the Subject
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Exercise 1

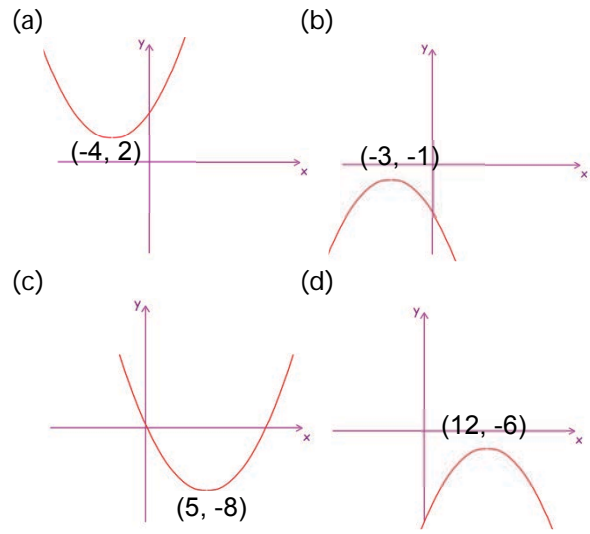
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = (x + 3)(x + 5)$ showing the y-intercept and turning point

Exercise 2

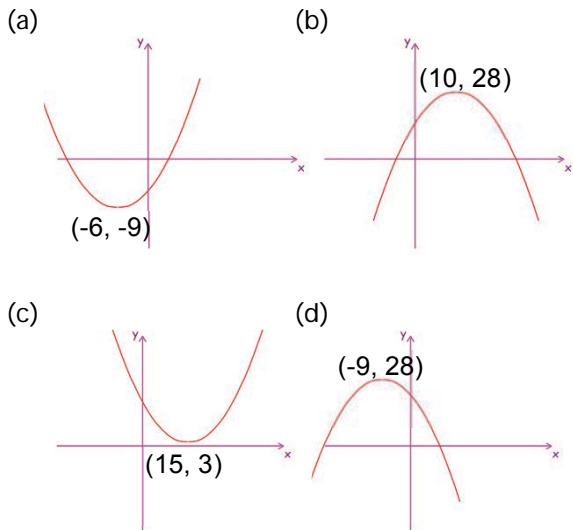
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = (x - 3)(x + 5)$ showing the y-intercept and turning point

Exercise 3

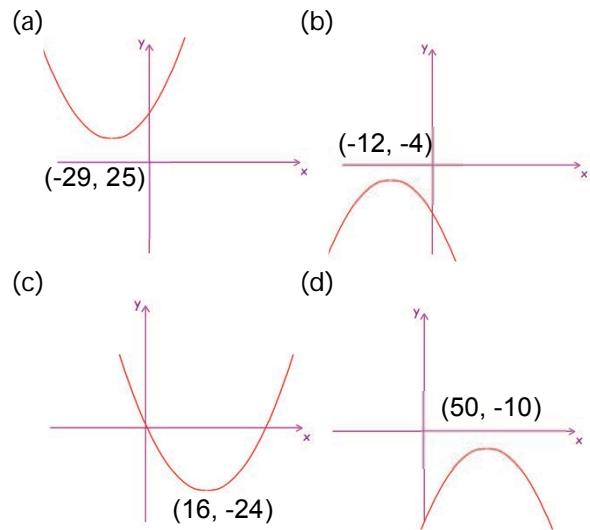
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = (x - 12)(x - 4)$ showing the y-intercept and turning point

Exercise 4

1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = (x - 6)(x + 10)$ showing the y-intercept and turning

Exercise 1

1. Solve the following quadratic equations:

- | | |
|------------------------|-------------------------|
| a. $x^2 + 7x = 0$ | b. $x^2 - 5x = 0$ |
| c. $x^2 - 25 = 0$ | d. $4x^2 - 49 = 0$ |
| e. $x^2 + 4x + 3 = 0$ | f. $x^2 + 13x + 30 = 0$ |
| g. $x^2 - 9x + 14 = 0$ | h. $x^2 - 12x + 20 = 0$ |
| i. $x^2 + 3x - 10 = 0$ | j. $x^2 - 4x - 32 = 0$ |

2. Solve the following quadratic equations to 2.d.p

- a. $2x^2 + 7x + 1 = 0$
- b. $2x^2 - 5x + 2 = 0$
- c. $4x^2 + 6x + 2 = 0$

Exercise 2

1. Solve the following quadratic equations:

- | | |
|-----------------------|-------------------------|
| a. $x^2 + 3x = 0$ | b. $x^2 - 12x = 0$ |
| c. $x^2 - 64 = 0$ | d. $9x^2 - 81 = 0$ |
| e. $x^2 + 6x + 5 = 0$ | f. $x^2 + 15x + 44 = 0$ |
| g. $x^2 - 5x + 6 = 0$ | h. $x^2 - 12x + 32 = 0$ |
| i. $x^2 + x - 20 = 0$ | j. $x^2 - x - 20 = 0$ |

2. Solve the following quadratic equations to 2.d.p

- a. $3x^2 + 9x + 5 = 0$
- b. $2x^2 - 3x - 7 = 0$
- c. $7x^2 + x - 2 = 0$

Exercise 3

1. Solve the following quadratic equations:

- | | |
|-------------------------|-------------------------|
| a. $x^2 + 9x = 0$ | b. $x^2 - 20x = 0$ |
| c. $x^2 - 100 = 0$ | d. $16x^2 - 25 = 0$ |
| e. $x^2 + 10x + 16 = 0$ | f. $x^2 + 12x + 35 = 0$ |
| g. $x^2 - 10x + 9 = 0$ | h. $x^2 - 17x + 70 = 0$ |
| i. $x^2 + 7x - 30 = 0$ | j. $x^2 - 4x - 21 = 0$ |

2. Solve the following quadratic equations to 2.d.p

- a. $2x^2 + 9x + 3 = 0$
- b. $x^2 - 6x - 1 = 0$
- c. $3x^2 + 4x - 5 = 0$

Exercise 4

1. Solve the following quadratic equations:

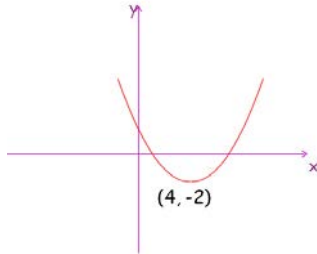
- | | |
|-------------------------|-------------------------|
| a. $x^2 + 14x = 0$ | b. $x^2 - 24x = 0$ |
| c. $x^2 - 144 = 0$ | d. $64x^2 - 9 = 0$ |
| e. $x^2 + 11x + 18 = 0$ | f. $x^2 + 17x + 30 = 0$ |
| g. $x^2 - 8x + 12 = 0$ | h. $x^2 - 15x + 36 = 0$ |
| i. $x^2 + 10x - 24 = 0$ | j. $x^2 - 48x - 49 = 0$ |

2. Solve the following quadratic equations to 2.d.p

- a. $2x^2 + 11x + 3 = 0$
- b. $x^2 - 7x - 7 = 0$
- c. $5x^2 + x - 3 = 0$

Exercise 1

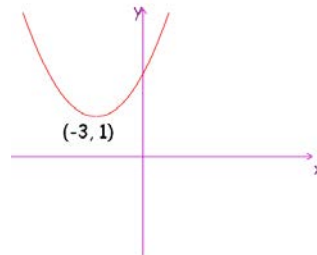
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = 2(x-3)(x+3)$ showing the y-intercept and turning point.
3. Solve $y = x^2 - 6x + 8$
4. Solve $y = 2x^2 - 6x + 3$ to 1.d.p.
5. Determine p where $3x^2 + 5x + p = 0$ has no real roots.

Exercise 2

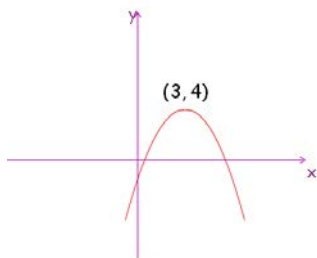
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = (x + 3)^2 - 3$ showing the y-intercept and turning point.
3. Solve $y = 2x^2 - 6x$
4. Solve $y = x^2 - x - 3$ to 1.d.p.
5. Determine p where $x^2 + 5x + p = 0$ has two distinct roots.

Exercise 3

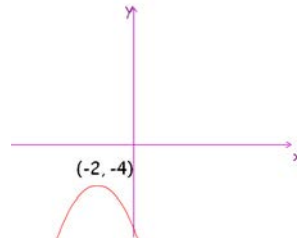
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = -(x + 3)^2 + 5$ showing the y-intercept and turning point.
3. Solve $y = 2x^2 - 18$
4. Solve $y = 2x^2 - 5x - 3$ to 1.d.p.
5. Determine p where $x^2 + 8x + p = 0$ has equal roots.

Exercise 4

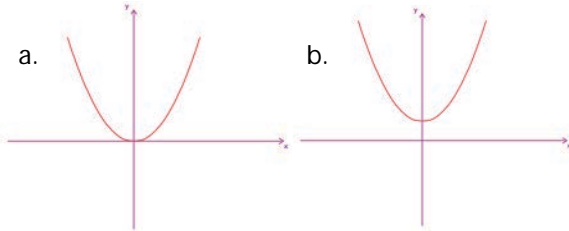
1. State the equation of the quadratic functions in the form $y = a(x \pm b)^2 \pm c$ (assume $a = \pm 1$)



2. Sketch the quadratic $y = -(x - 4)^2 + 2$ showing the y-intercept and turning point.
3. Solve $y = 2x^2 + 5x - 12$
4. Solve $y = x^2 - x - 3$ to 1.d.p.
5. Determine p where $2x^2 + 12x + p = 0$ has two distinct roots.

Exercise 1

1. For each of the parabolas below, state the nature of the roots and whether the parabola is positive or negative:

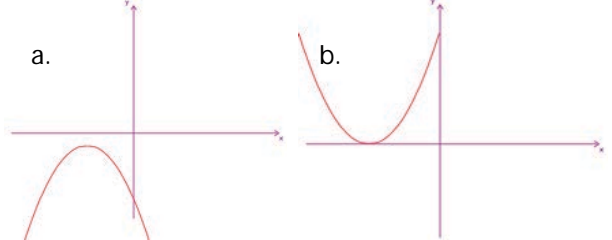


2. Use the discriminant to determine the nature of the roots in the quadratics below:

a. $x^2 + 6x - 1 = 0$ b. $x^2 + 7 = 0$
 c. $x^2 - 100 = 0$ d. $x^2 + 6x + 9 = 0$
 e. $-x^2 + 2x - 3 = 0$ f. $-x^2 + 9 = 0$

Exercise 2

1. For each of the parabolas below, state the nature of the roots and whether the parabola is positive or negative:

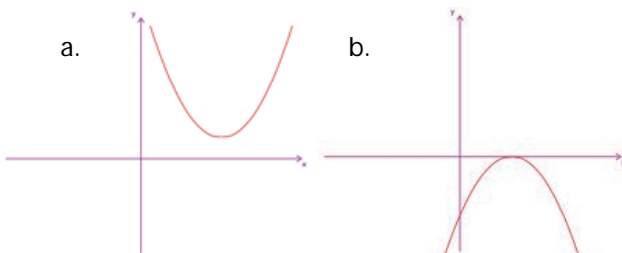


2. Use the discriminant to determine the nature of the roots in the quadratics below:

a. $x^2 + 3x + 6 = 0$ b. $x^2 + 8x = 0$
 c. $x^2 - 25 = 0$ d. $-x^2 + 5x - 2 = 0$
 e. $x^2 + 4x + 4 = 0$ f. $-x^2 + 2x - 9 = 0$

Exercise 3

1. For each of the parabolas below, state the nature of the roots and whether the parabola is positive or negative:

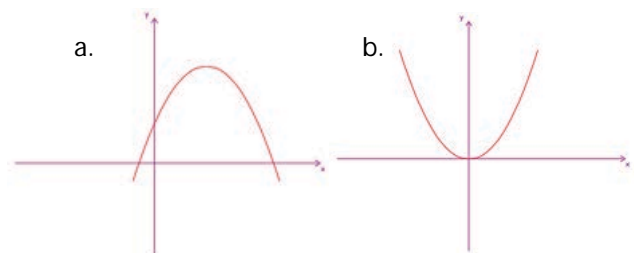


2. Use the discriminant to determine the nature of the roots in the quadratics below:

a. $x^2 + 3x = 0$ b. $x^2 - 8x + 16 = 0$
 c. $x^2 + 5x + 6 = 0$ d. $-x^2 - 3 = 0$
 e. $x^2 + x + 6 = 0$ f. $-x^2 - x - 1 = 0$

Exercise 4

1. For each of the parabolas below, state the nature of the roots and whether the parabola is positive or negative:

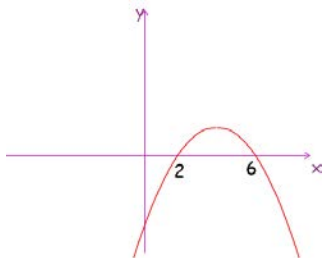


2. Use the discriminant to determine the nature of the roots in the quadratics below:

a. $4x^2 - 25 = 0$ b. $2x^2 + 7x = 0$
 c. $x^2 - 3x - 18 = 0$ d. $x^2 + 12x + 36 = 0$
 e. $-x^2 - 5 = 0$ f. $-x^2 + 2 = 0$

Exercise 1

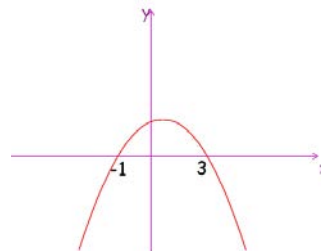
1. (a) Solve the quadratic.



- (b) State the equation of the axis of symmetry.
2. Sketch the quadratic $y = (x - 2)(x + 4)$ showing the y-intercept and turning point.
3. Solve $a^2 = 10a$
4. Find the height of a cone with volume 400cm^3 and radius 5cm .

Exercise 2

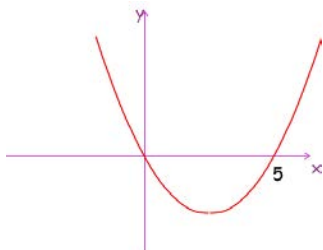
1. (a) Solve the quadratic.



- (b) State the equation of the axis of symmetry.
2. Sketch the quadratic $y = -(x - 5)(x + 3)$ showing the y-intercept and turning point.
3. Solve $8x = 2x^2$
4. Find the radius of a sphere with volume 800cm^3 .

Exercise 3

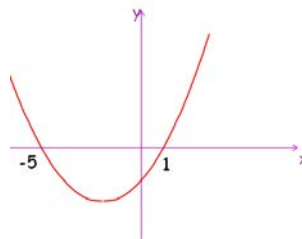
1. (a) Solve the quadratic.



- (b) State the equation of the axis of symmetry.
2. Sketch the quadratic $y = (x + 4)(x + 2)$ showing the y-intercept and turning point.
3. Solve $n^2 = 24 - 2n$
4. Find the radius of a cylinder with volume 200cm^3 and height 20cm .

Exercise 4

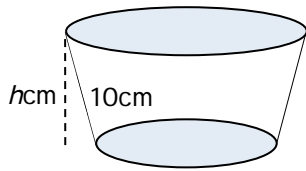
1. (a) Solve the quadratic.



- (b) State the equation of the axis of symmetry.
2. Sketch the quadratic $y = -(x + 4)(x - 8)$ showing the y-intercept and turning point.
3. Solve $y^2 + 12 = 7y$
4. Find the radius of a hemisphere with volume 300cm^3 .

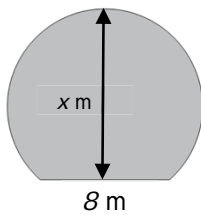
Exercise 1

1. The lid of the ice cream tub below has a diameter of 14cm and the base has diameter 12cm. Find the height 'h' of the ice cream tub

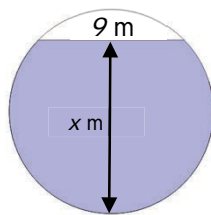


2. Find the 'x' in each question:

a. Radius = 10m

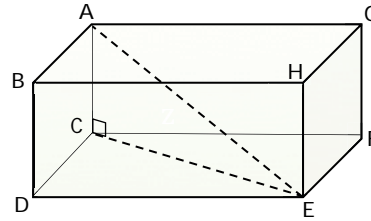


b. Radius = 6m



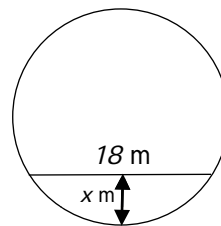
Exercise 2

1. In the diagram below, $CD = 6\text{cm}$, $DE = 12\text{cm}$ and $BD = 8\text{cm}$. Find the length of the line AE .

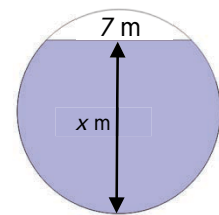


2. Find the 'x' in each question:

a. Radius = 11m

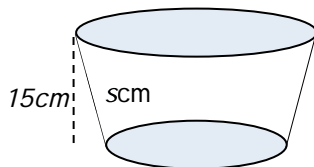


b. Radius = 5m



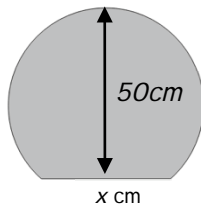
Exercise 3

1. The lid of the ice cream tub below has a diameter of 18cm and the base has diameter 15cm. Find the slope height 's' of the ice cream tub

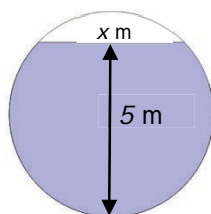


2. Find the 'x' in each question:

b. Radius = 36cm

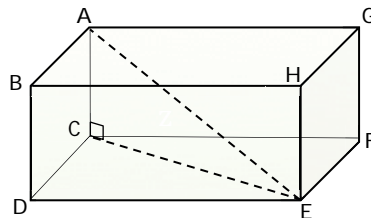


b. Radius = 3m



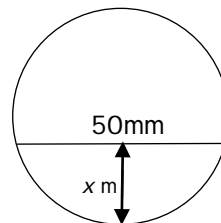
Exercise 4

1. In the diagram below, $CD = 50\text{cm}$, $DE = 80\text{cm}$ and $BD = 35\text{cm}$. Find the length of the line AE .

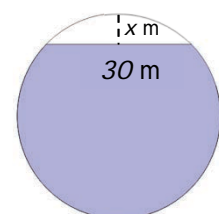


2. Find the 'x' in each question:

c. Radius = 30mm



b. Radius = 20m

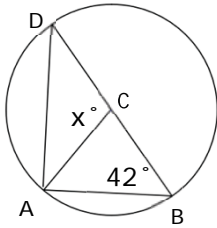


Relationships

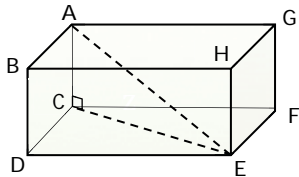
Pythagoras

Exercise 1

1. Find the size of angle x :



2. In the diagram below, $CD = 20\text{cm}$, $DE = 60\text{cm}$ and $BD = 40\text{cm}$. Find the length of the line AE .

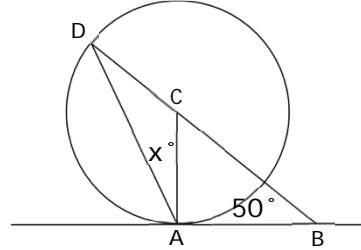


3. The shapes are similar. If the smaller shape is 150cm^2 . Find the area of the larger shape:

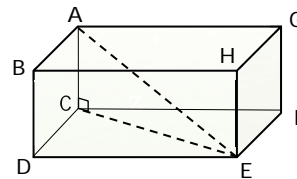


Exercise 2

1. Find the size of angle x :



2. In the diagram below, $CD = 65\text{cm}$, $DE = 63\text{cm}$ and $BD = 85\text{cm}$. Find the length of the line AE .

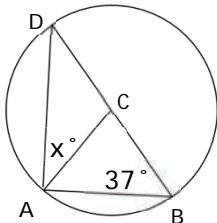


3. The shapes are similar. If the smaller shape is 800cm^3 . Find the volume of the larger shape:

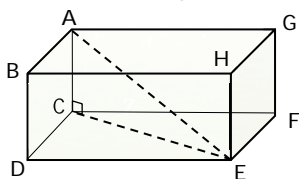


Exercise 3

1. Find the size of angle x :



2. In the diagram below, $CD = 2\text{cm}$, $DE = 3\text{cm}$ and $BD = 4\text{cm}$. Find the length of the line AE .

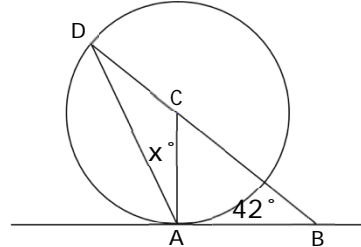


4. The shapes are similar. If the smaller shape is 560cm^2 . Find the area of the larger shape:

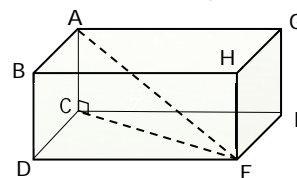


Exercise 4

1. Find the size of angle x :



2. In the diagram below, $CD = 4.5\text{cm}$, $DE = 4.8\text{cm}$ and $BD = 6.7\text{cm}$. Find the length of the line AE .



3. The shapes are similar. If the smaller shape is 600cm^3 . Find the volume of the larger shape:

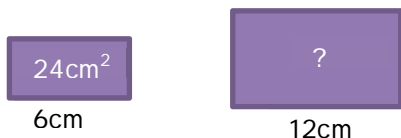


Relationships

Angle Properties and Similar Figures

Exercise 1

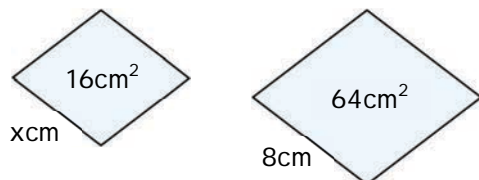
1. These two rectangles below are similar. Find (a) the area scale factor and (b) the unknown area.



2. The two trapeziums are similar. Find (a) the area scale factor and (b) the unknown area.

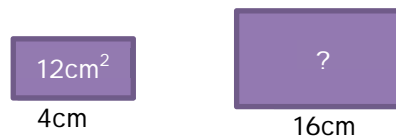


3. The two shapes are similar. Calculate (a) the area scale factor (b) find side x:



Exercise 2

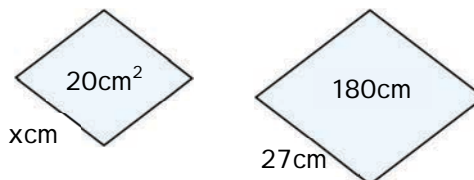
1. These two rectangles below are similar. Find (a) the area scale factor and (b) the unknown area.



2. The two trapeziums are similar. Find (a) the area scale factor and (b) the unknown area.

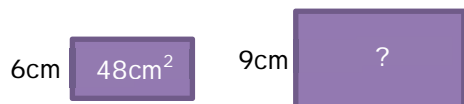


3. The two shapes are similar. Calculate (a) the area scale factor (b) find side x:



Exercise 3

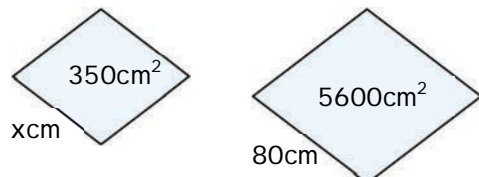
1. These two rectangles below are similar. Find (a) the area scale factor and (b) the unknown area.



2. The two trapeziums are similar. Find (a) the area scale factor and (b) the unknown area.

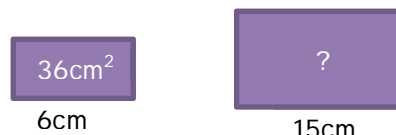


3. The two shapes are similar. Calculate (a) the area scale factor (b) find side x:



Exercise 4

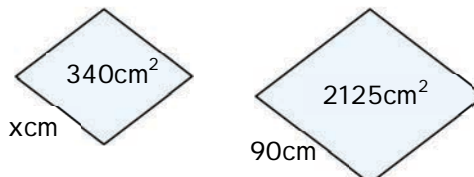
1. These two rectangles below are similar. Find (a) the area scale factor and (b) the unknown area.



2. The two trapeziums are similar. Find (a) the area scale factor and (b) the unknown area.



3. The two shapes are similar. Calculate (a) the area scale factor (b) find side x:

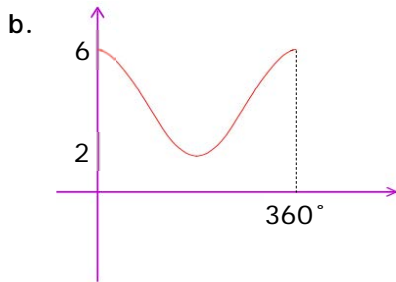
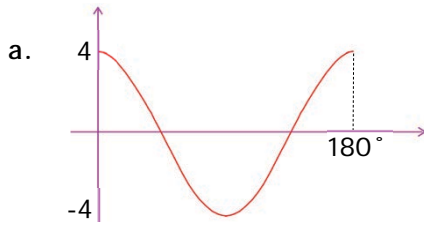


Relationships

Similar Figures

Exercise 1

1. Determine the equation and state the period of each trig graph:

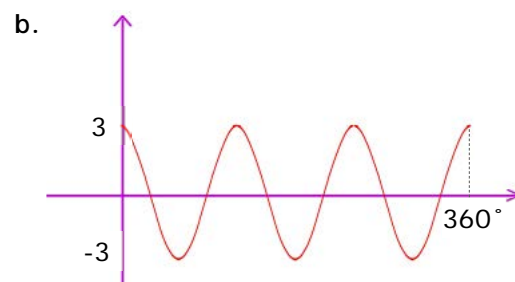
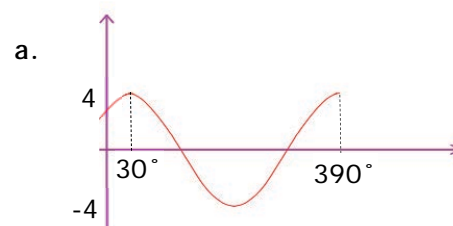


2. Solve the following equations for $0 \leq x \leq 360$:

a. $2\cos x - 1 = 0$ b. $3\tan x + 1 = 0$

Exercise 2

1. Determine the equation and state the period of each trig graph:

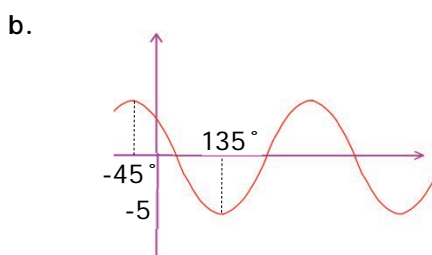
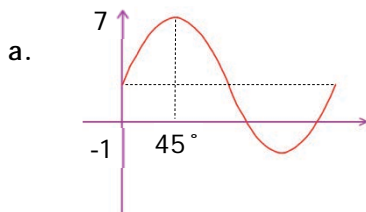


2. Solve the following equations for $0 \leq x \leq 360$:

a. $3\sin x + 1 = 0$ b. $5\tan x - 4 = 0$

Exercise 3

1. Determine the equation and state the period of each trig graph:

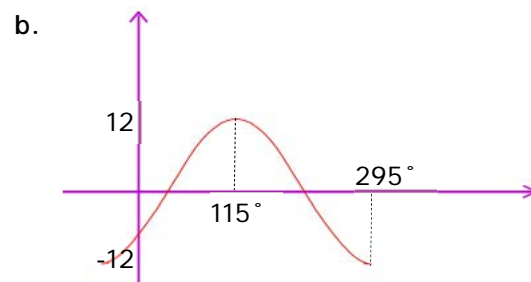
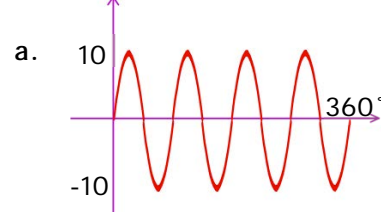


2. Solve the following equations for $0 \leq x \leq 360$:

a. $\sqrt{2}\cos x - 1 = 0$ b. $2\sin x - \sqrt{3} = 0$

Exercise 4

1. Determine the equation and state the period of each trig graph:



2. Solve the following equations for $0 \leq x \leq 360$:

a. $5\cos x + 1 = -3$ b. $3\tan x - 5 = 0$

Relationships	Trig Graphs
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<p>Exercise 1</p> <p>1. On a suitable set of axes, sketch each of the following graphs:</p> <p>a. $y = 2\sin x$ b. $y = -3\cos x$</p> <p>c. $y = \cos x + 2$ d. $y = \sin(x - 30)$</p> <p>2. Solve the following equations for $0 \leq x \leq 360$:</p> <p>a. $4\cos x - 1 = 0$ b. $2\tan x - 1 = 0$</p> <p>c. $3\sin x + 3 = 4$ d. $4\tan x - 1 = 2$</p> <p>3. Prove that $\tan x \cos x = \sin x$</p>	<p>Exercise 2</p> <p>1. On a suitable set of axes, sketch each of the following graphs:</p> <p>a. $y = 3\sin x$ b. $y = 3\cos x + 1$</p> <p>c. $y = \cos x + 2$ d. $y = \sin(x - 45)$</p> <p>2. Solve the following equations for $0 \leq x \leq 360$:</p> <p>a. $3\cos x + 1 = 2$ b. $2\tan x - 2 = 0$</p> <p>c. $\frac{1}{3}\sin x = \frac{\sqrt{3}}{6}$ d. $3\tan x - 1 = 1$</p> <p>3. Prove that $\tan x \sin x = \cos x$</p>
<p>Exercise 3</p> <p>1. On a suitable set of axes, sketch each of the following graphs:</p> <p>a. $y = \sin x - 2$ b. $y = 4\cos 3x$</p> <p>c. $y = -\cos x - 1$ d. $y = \sin(x - 60)$</p> <p>2. Solve the following equations for $0 \leq x \leq 360$:</p> <p>a. $10\cos x + 1 = -1$ b. $\tan x + 1 = 1 + \sqrt{3}$</p> <p>c. $-2\sin x = 1$ d. $3\tan x + 1 = 2$</p> <p>3. Prove that $\tan x \cos^2 x = \sin x \cos x$</p>	<p>Exercise 4</p> <p>1. On a suitable set of axes, sketch each of the following graphs:</p> <p>a. $y = -4\sin 2x$ b. $y = 5\cos 4x$</p> <p>c. $y = \sin 3x + 2$ d. $y = 2\sin(x + 25)$</p> <p>2. Solve the following equations for $0 \leq x \leq 360$:</p> <p>a. $2\cos x - 1 = 1$ b. $5\tan x + 1 = 0$</p> <p>c. $2\sin x - 3 = -4$ d. $2\tan x + 3 = 1$</p> <p>3. Prove that $\frac{\sin^2 x}{\cos x} = \tan x \sin x$</p>

Relationships	Trig Graphs, Trig Equations and Trig Identities
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Exercise 1

1. Solve the following equations for $0 \leq x \leq 360$:

a. $\cos x + 0.5 = 0$ b. $3 \tan x - 0.9 = 0$

c. $10 \sin x - 5 = 5$ d. $\frac{1}{2} \tan x + 6 = 2$

2. Prove that $1 - \sin^2 x = \cos^2 x$

3. Prove that $\frac{1 - \cos^2 x}{\cos^2 x} = \tan^2 x$

4. Sketch the graph of $y = -\cos x + 2$

Exercise 2

1. Solve the following equations for $0 \leq x \leq 360$:

a. $\cos x - 0.8 = 0$ b. $2 \tan x + 0.8 = 0$

c. $\sin x + 0.5 = 1$ d. $3 \tan x - 8 = 1$

2. Prove that $2 - 2 \cos^2 x = 2 \sin^2 x$

3. Prove that $\frac{1 - \sin^2 x}{\cos^2 x} = 1$

4. Sketch the graph of $y = -\sin x - 2$

Exercise 3

1. Solve the following equations for $0 \leq x \leq 360$:

a. $\cos x - 0.2 = 0$ b. $5 \tan x - 0.6 = 0$

c. $5 \sin x + 5 = 0$ d. $3 \tan x - 4 = 8$

2. Prove that $\sin^2 x - 1 = \cos^2 x$

3. Prove that $\frac{1 - \sin^2 x}{1 - \cos^2 x} = \frac{1}{\tan^2 x}$

4. Sketch the graph of $y = -3 \cos x + 2$

Exercise 4

1. Solve the following equations for $0 \leq x \leq 360$:

a. $\cos x - 0.4 = 0.5$ b. $4 \tan x + 0.6 = 0$

c. $12 \sin x - 5 = 6$ d. $5 \tan x - 3 = 4$

2. Prove that $(\sin x + \cos x)^2 = 1 + 2 \sin x \cos x$

3. Prove that $\frac{1 - \cos^2 x}{\sin^2 x} = 1$

4. Sketch the graph of $y = -2 \sin x - 2$

Relationships

Trig Graphs, Trig Equations and Trig Identities

Exercise 1

1. Prove that $2 - \cos^2 x = \sin^2 x + 1$
2. Prove that $\frac{\sin^2 x + \cos^2 x}{\cos^2 x} = \tan^2 x + 1$
3. Prove that $1 - \sin^2 x = \frac{\sin^2 x}{\tan^2 x}$
4. Prove that $\frac{\sin^2 x + \cos^2 x}{\tan^2 x} = \frac{\cos^2 x}{\sin^2 x}$
5. Solve: $2\sin x = \sin^2 x + \cos^2 x \quad 0 \leq x \leq 360$

Exercise 2

1. Prove that $3 + \cos^2 x = -\sin^2 x + 4$
2. Prove that $\frac{1}{\cos^2 x} = \tan^2 x + 1$
3. Prove that $\sin^2 x - \sin^4 x = \sin^2 x \cos^2 x$
4. Prove that $\frac{\sin^2 x + \cos^2 x}{\cos^2 x \tan^2 x} = \frac{1}{\sin^2 x}$
5. Solve: $2\sin x = 1 + \sin^2 x + \cos^2 x \quad 0 \leq x \leq 360$

Exercise 3

1. Prove that $2 + \cos^2 x = \sin^2 x + 1 + 2\cos^2 x$
2. Prove that $\frac{\sin^2 + \cos^2 x}{\cos^2 x} = \tan^2 x + \sin^2 + \cos^2$
3. Prove that $1 - \sin^2 x = \frac{1 - \cos^2 x}{\tan^2 x}$
4. Prove that $\frac{\sin^2 x + \cos^2 x}{\tan^2 x} = \frac{\cos^2 x}{\sin^2 x}$
5. Solve: $3\sin x - 1 = \sin^2 x + \cos^2 x \quad 0 \leq x \leq 360$

Exercise 4

1. Prove that $2 - \sin^2 x = \cos^2 x + 1$
2. Prove that $(\sin x + \cos x)^2 = 1 + 2\sin x \cos x$
3. Prove that $1 = \frac{\sin^2 x}{\tan^2 x} + \sin^2 x$
4. Prove that $\frac{1}{\tan^2 x} = \frac{1 - \sin^2 x}{\sin^2 x}$
5. Solve: $-\sin x - \sin^2 x = \cos^2 x \quad 0 \leq x \leq 360$