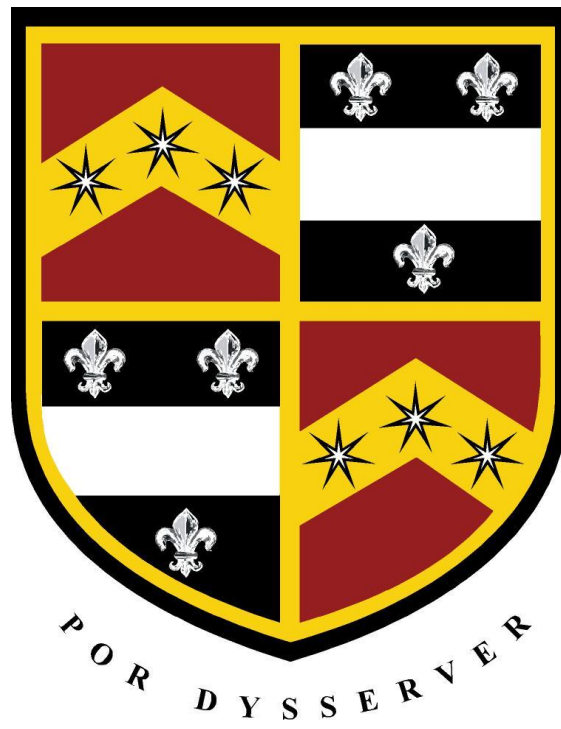


Carre's Grammar School A level Maths Work book

Bridging the gap from GCSE to A level



Surds Practice

Using the rules: $\sqrt{ab} = \sqrt{a}\sqrt{b}$ and $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

1) Simplify the following:

- | | | | |
|----------------|----------------|-----------------|----------------|
| a. $\sqrt{12}$ | b. $\sqrt{20}$ | c. $\sqrt{18}$ | d. $\sqrt{27}$ |
| e. $\sqrt{8}$ | f. $\sqrt{24}$ | g. $\sqrt{28}$ | h. $\sqrt{32}$ |
| i. $\sqrt{45}$ | j. $\sqrt{48}$ | k. $\sqrt{44}$ | l. $\sqrt{63}$ |
| m. $\sqrt{50}$ | n. $\sqrt{54}$ | o. $\sqrt{200}$ | |

2) Add or subtract:

- | | | | |
|----------------------------|----------------------------|----------------------------|----------------------------|
| a. $4\sqrt{2} + 3\sqrt{2}$ | b. $5\sqrt{2} - 3\sqrt{2}$ | c. $6\sqrt{3} + 2\sqrt{3}$ | d. $6\sqrt{3} - 2\sqrt{3}$ |
| e. $\sqrt{5} + \sqrt{5}$ | f. $\sqrt{5} - \sqrt{5}$ | g. $8\sqrt{2} + 2\sqrt{2}$ | h. $2\sqrt{3} - \sqrt{3}$ |
| i. $3\sqrt{3} + 3\sqrt{3}$ | | | |

3) Simplify and express as a single surd:

- | | | | |
|----------------------------|----------------------------|-----------------------------|----------------------------|
| a. $\sqrt{8} + \sqrt{2}$ | b. $\sqrt{18} - \sqrt{2}$ | c. $\sqrt{125} - 5\sqrt{5}$ | d. $\sqrt{48} - \sqrt{12}$ |
| e. $\sqrt{32} + \sqrt{18}$ | f. $\sqrt{75} - \sqrt{12}$ | g. $\sqrt{45} - \sqrt{20}$ | h. $\sqrt{63} - \sqrt{28}$ |

4) Simplify:

- | | | | |
|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| a. $\sqrt{2} \times \sqrt{2}$ | b. $\sqrt{6} \times \sqrt{6}$ | c. $\sqrt{2} \times \sqrt{50}$ | d. $\sqrt{3} \times \sqrt{12}$ |
| e. $\sqrt{3} \times \sqrt{27}$ | f. $\sqrt{10} \times \sqrt{2}$ | g. $\sqrt{3} \times \sqrt{15}$ | h. $\sqrt{5} \times \sqrt{10}$ |

5) Multiply out the brackets and simplify where appropriate:

- | | | |
|-----------------------------------|---|---|
| a. $(2 + \sqrt{2})(3 + \sqrt{2})$ | b. $(2 + \sqrt{2})(3 - \sqrt{2})$ | c. $(5 - \sqrt{3})(5 + \sqrt{3})$ |
| d. $(\sqrt{3} - \sqrt{2})^2$ | e. $\left(\frac{1}{\sqrt{2}} + \sqrt{2}\right)\left(\frac{1}{\sqrt{2}} - \sqrt{2}\right)$ | f. $\frac{2}{\sqrt{3}}\left(\frac{1}{\sqrt{3}} - \frac{\sqrt{3}}{2}\right)$ |

6) Rationalise the following surds:

a. $\frac{1}{\sqrt{6}}$

b. $\frac{1}{\sqrt{7}}$

c. $\frac{2}{\sqrt{6}}$

d. $\frac{3}{\sqrt{3}}$

e. $\frac{5}{\sqrt{10}}$

f. $\frac{1}{\sqrt{11}}$

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

h. $\frac{20}{\sqrt{5}}$

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

j. $\frac{12}{\sqrt{6}}$

Indices Practice

1) Simplify, giving answers in index form:

a) $6^3 \times 6^2 =$ _____

b) $5^5 \times 5^7 =$ _____

c) $2^7 \times 2^9 =$ _____

d) $7^4 \times 7^6 =$ _____

e) $9^9 \times 9 =$ _____

f) $8^2 \times 8^4 =$ _____

2) Simplify, leaving answers in index form:

a) $4^{14} \div 4^{10} =$ _____

b) $10^{12} \div 10^3 =$ _____

c) $3^{14} \div 3^4 =$ _____

d) $9^{14} \div 9^9 =$ _____

e) $2^{12} \div 2^{10} =$ _____

f) $8^{15} \div 8^8 =$ _____

3) Simplify, leaving answers in index form:

a) $(5^7)^7 =$ _____

b) $(6^2)^5 =$ _____

c) $(4^2)^6 =$ _____

d) $(3)^6 =$ _____

e) $(10^6)^4 =$ _____

f) $(7^7)^{10} =$ _____

4) Simplify, leaving answers in index form:

a) $9^{13} \div 9^3 =$ _____

b) $(2^9)^5 =$ _____

c) $8^4 \times 8 =$ _____

d) $(6^5)^4 =$ _____

e) $3^{10} \div 3^8 =$ _____

f) $4^{10} \times 4^2 =$ _____

5) Work out the following:

a) $3^{-1} =$ _____

b) $8^0 =$ _____

c) $5^0 =$ _____

d) $5^{-2} =$ _____

e) $7^{-2} =$ _____

f) $9^0 =$ _____

6) Work out the following:

a) $16^{1/2} =$ _____

b) $100^{1/2} =$ _____

c) $216^{1/3} =$ _____

d) $8000^{1/3} =$ _____

e) $4^{1/2} =$ _____

f) $125^{1/3} =$ _____

7) Work out the following:

a) $8^{-1/3} =$ _____

b) $1000^{-1/3} =$ _____

c) $64^{-1/3} =$ _____

d) $25^{-1/2} =$ _____

e) $343^{-1/3} =$ _____

f) $512^{-1/3} =$ _____

8) Work out the following:

a) $8^{5/3} =$ _____

b) $4^{5/2} =$ _____

c) $100^{3/2} =$ _____

d) $8^{2/3} =$ _____

e) $32^{3/5} =$ _____

f) $81^{3/4} =$ _____

9) Work out the following:

a) $64^{-2/3} =$ _____

b) $8^{-4/3} =$ _____

c) $32^{-4/5} =$ _____

d) $32^{-2/5} =$ _____

e) $125^{-2/3} =$ _____

f) $1000^{-2/3} =$ _____

Algebraic Skills Practice

Simpler examples (unknown appears once)

Make x the subject of each of the following formulae.

(a) $y = 4x$

(b) $y = 2x + 3$

(c) $y = 4x - 8$

(d) $y = \frac{x + 2}{4}$

(e) $y = \frac{x - 2}{5}$

(f) $y = x + a$

(g) $y = \frac{x - b}{a}$

(h) $y = ax + c$

(i) $y = \frac{ax + b}{c}$

(j) $y = \frac{ax - c}{b}$

(k) $y = a + b + x$

(l) $y = \frac{x - a + b}{c}$

(m) $y = abx$

(n) $y = abx + c$

(o) $y = \frac{4ax - b}{3c}$

(p) $p = \frac{ax - bc}{d}$

(q) $y = (a + x)b$

(r) $y = \frac{(3 + x)a}{4}$

(s) $q = \frac{3(x - 4)}{2}$

(t) $v = \frac{5(x + y)}{4}$

(u) $z = a + \frac{(x - 3)}{4}$

Harder examples (unknown appears twice)

Make the letter in brackets the subject.

$$1. mx = lx + p \quad (x)$$

$$2. m = \frac{uL}{L + rcR} \quad (L)$$

$$3. P = \frac{e^2m - e^2n}{S} \quad (e)$$

$$4. a + x = \frac{y}{2 + y} \quad (y)$$

$$5. \frac{1}{x} = \frac{4K - 2b}{3c + 5K} \quad (K)$$

Make the letter in brackets the subject.

$$1. g = \sqrt{\frac{d + s}{d}} \quad (d)$$

$$2. \frac{D}{d} = \sqrt{\frac{f + p}{f - p}} \quad (p)$$

$$3. x^2 = \frac{y^2 - r^2}{y^2} \quad (y)$$

$$4. T = 4\pi \sqrt{\frac{(M + 3m)l}{3(M + 2m)g}} \quad (m)$$

Solving Quadratics

Simpler cases (no coefficient of x^2)

Factorise the following:

- a) $x^2 + 8x + 15$ b) $x^2 + 10x + 24$ c) $x^2 + 9x + 8$ d) $x^2 + 15x + 36$
e) $x^2 + 2x - 3$ f) $x^2 + 2x - 8$ g) $x^2 - 2x - 3$ h) $x^2 + 7x - 18$
i) $x^2 - 12x + 35$ j) $x^2 - 11x + 10$ k) $x^2 - 13x + 22$ l) $x^2 + 12x + 27$

Harder cases (coefficient of x^2 greater than 1)

Factorise the following:

- a) $2x^2 + 11x + 5$ b) $3x^2 + 19x + 6$ c) $3x^2 + 17x - 6$ d) $6x^2 + 7x + 2$
e) $7x^2 - 6x - 1$ f) $12x^2 + 7x + 1$ g) $8x^2 + 6x + 1$ h) $8x^2 - 6x + 1$

Solving by Factorising

Solve the following by factorising first:

1) $x^2 - 9x + 18 = 0$

2) $x^2 + 5x + 4 = 0$

3) $n^2 - 64 = 0$

4) $b^2 + 5b = 0$

5) $35n^2 + 22n + 3 = 0$

6) $15b^2 + 4b - 4 = 0$

7) $7p^2 - 38p - 24 = 0$

8) $3x^2 + 14x - 49 = 0$

9) $3k^2 - 18k - 21 = 0$

10) $6k^2 - 42k + 72 = 0$

Completing the Square

Solve the following by completing the square:

1) $a^2 + 2a - 3 = 0$

3) $p^2 + 16p - 22 = 0$

5) $r^2 + 2r - 33 = 0$

7) $m^2 - 12m + 26 = 0$

9) $k^2 - 8k - 48 = 0$

11) $m^2 + 2m - 48 = -6$

2) $a^2 - 2a - 8 = 0$

4) $k^2 + 8k + 12 = 0$

6) $a^2 - 2a - 48 = 0$

8) $x^2 + 12x + 20 = 0$

10) $p^2 + 2p - 63 = 0$

12) $p^2 - 8p + 21 = 6$

Algebraic Fractions

Simplifying algebraic fractions

Simplify the following fractions:

1) (a) $\frac{30}{66}$ (b) $\frac{5x^4}{15x}$ (c) $\frac{12xy^4}{18x^3y^2}$ (d) $\frac{5m^2n}{10m^3n^3}$ (e) $\frac{12a^4b^6}{2a^3b^4}$

2) (a) $\frac{5x - 15}{x^2 - 9}$ (b) $\frac{a^2 - 5a + 6}{3a^2 - 6a}$

(c) $\frac{3x^2 + 14x - 5}{3x^2 + 2x - 1}$ (d) $\frac{5p - 15}{p^2 - 4}$

Adding/ Subtracting Fractions

Evaluate the following:

Section 1

(a) $\frac{x}{3} + \frac{x}{2}$

(b) $\frac{m}{7} - \frac{m}{5}$

(c) $\frac{4t}{5} + \frac{t}{2}$

(d) $\frac{m+1}{3} - \frac{m-2}{4}$

(e) $\frac{3m+4}{7} + \frac{m-1}{2}$

(f) $\frac{y}{y+1} - \frac{y}{y+3}$

(g) $\frac{5}{t+1} + \frac{4}{t-3}$

(h) $\frac{3m}{m+4} + \frac{4m}{m+5}$

(i) $\frac{4}{y+1} - \frac{5}{y+2}$

(j) $\frac{7}{4x} + \frac{2}{5xy}$

Section 2

$$(a) \frac{m}{16} \div \frac{5m}{12}$$

$$(b) \frac{3m}{8} \div \frac{15m}{20}$$

$$(c) \frac{6x+3}{8} \div \frac{2x+1}{12}$$

$$(d) \frac{9xy}{7} \div \frac{6x}{3}$$

$$(e) \frac{6pq}{5} \div \frac{12p}{7}$$

$$(f) \frac{3(x+1)}{8} \div \frac{5(x+1)}{16}$$

Solving Equations

Solve the following for x:

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

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

$$(c) \frac{3(x-2)}{4} - \frac{2(x+1)}{5} = \frac{1}{10}$$

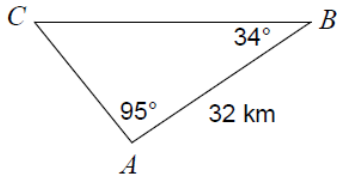
$$(d) \frac{4}{x+1} + \frac{3}{x-4} = \frac{2}{x+1}$$

$$(e) \frac{5}{x+3} + \frac{2}{2x+6} = 4$$

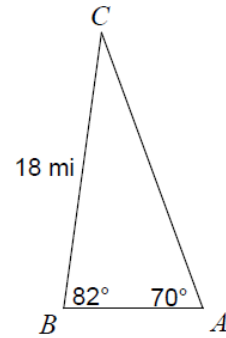
Trigonometry

Solve the following using Sine Rule:

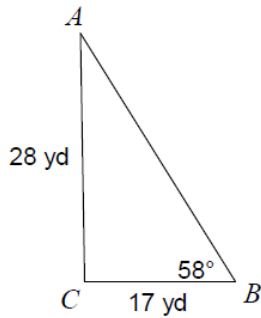
1) Find AC



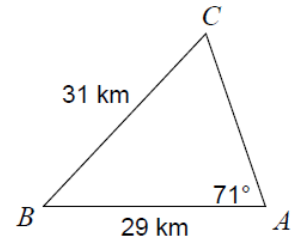
2) Find AC



3) Find $m\angle A$

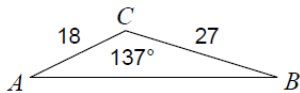


4) Find $m\angle C$



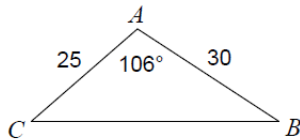
Solve the following using Cosine Rule

1) Find AB

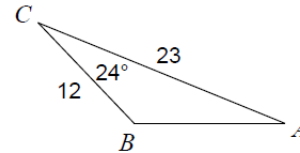


2) $m\angle C = 34^\circ$, $b = 30$, $a = 14$
Find c

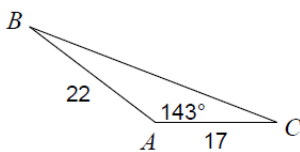
3) Find BC



4) Find AB



5) Find BC



6) $m\angle C = 109^\circ$, $b = 14$, $a = 13$
Find c

Mixed questions for Sine rule and cosine rule:

