



Perth Academy  
Mathematics Department  
Intermediate 2  
Unit 3 - Revision Pack

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## Algebraic Operations 1 ~ Fractions 1

**Q1.** Express these fractions in their simplest form.

<b>a.</b> $\frac{3}{6}$	<b>b.</b> $\frac{8}{12}$	<b>c.</b> $\frac{30}{16}$	<b>d.</b> $\frac{54}{72}$
<b>e.</b> $\frac{10a}{5}$	<b>f.</b> $\frac{9b}{6}$	<b>g.</b> $\frac{18}{12x}$	<b>h.</b> $\frac{25}{15y}$
<b>i.</b> $\frac{4c}{16c^2}$	<b>j.</b> $\frac{32a}{8a^3}$	<b>k.</b> $\frac{13p^2}{52p^3}$	<b>l.</b> $\frac{36ab}{6bc}$
<b>m.</b> $\frac{30p^2q}{25pq^2}$	<b>n.</b> $\frac{81x^2y^2}{6y^2}$	<b>o.</b> $\frac{42mn^2}{56mn}$	<b>p.</b> $\frac{8def^2}{10e^2f}$

**Q2.** Simplify by first finding the common factor.

<b>a.</b> $\frac{3a+6b}{6}$	<b>b.</b> $\frac{4x+12y}{2}$	<b>c.</b> $\frac{3a+a^2}{ab}$	<b>d.</b> $\frac{xy+y^2}{2y}$
<b>e.</b> $\frac{xy+x^2}{6x+xy}$	<b>f.</b> $\frac{3ab+6b^2}{9b^2}$	<b>g.</b> $\frac{25b^2+15b^3}{10b}$	<b>h.</b> $\frac{14p+10q}{2s}$
<b>i.</b> $\frac{3a}{2ab-ac}$	<b>j.</b> $\frac{6x}{9x+9y}$	<b>k.</b> $\frac{2st}{6rs-2st}$	<b>l.</b> $\frac{5c}{10ac+15bc}$
<b>m.</b> $\frac{14p+28p^2}{8+16p}$	<b>n.</b> $\frac{8c+4d}{6ac+3ad}$	<b>o.</b> $\frac{8n^2-2n}{12n-3}$	<b>p.</b> $\frac{15x^2+6xy}{10x+4y}$

**Q3.** Simplify the following.

<b>a.</b> $\frac{b^2-4}{b+2}$	<b>b.</b> $\frac{x^2-81}{x-9}$	<b>c.</b> $\frac{a^2-25}{a+5}$	<b>d.</b> $\frac{y^2-36}{y+6}$
<b>e.</b> $\frac{c^2-49}{2c-14}$	<b>f.</b> $\frac{a^2-64}{2a+16}$	<b>g.</b> $\frac{p^2-1}{5p-5}$	<b>h.</b> $\frac{q^2-9}{3q+9}$
<b>i.</b> $\frac{a^2-b^2}{3a+3b}$	<b>j.</b> $\frac{x^2-y^2}{5x-5y}$	<b>k.</b> $\frac{2m^2-18}{2m+6}$	<b>l.</b> $\frac{3d^2-48}{12d-48}$
<b>m.</b> $\frac{x^2+3x+2}{x+1}$	<b>n.</b> $\frac{p-1}{p^2-2p+1}$	<b>o.</b> $\frac{ax-5a}{x^2-25}$	<b>p.</b> $\frac{a^2-1}{a^2+2a+1}$
<b>q.</b> $\frac{b^2-6b+9}{b^2-9}$	<b>r.</b> $\frac{c^2+2c-15}{c^2-25}$	<b>s.</b> $\frac{3x^2+5x-2}{x^2-4}$	
<b>t.</b> $\frac{y^2+6y+8}{y^2+y-12}$	<b>u.</b> $\frac{p^2-4p-5}{p^2+2p+1}$	<b>v.</b> $\frac{c^2+4c-32}{c^2+c-56}$	
<b>w.</b> $\frac{2x^2+13x+6}{x^2+9x+18}$	<b>x.</b> $\frac{6a^2-13a-5}{3a^2-11a-4}$	<b>y.</b> $\frac{10b^2-33b-7}{10b^2-37b+7}$	

## Algebraic Operations 1 ~ Fractions 2

**Q1.** Express each sum as a fraction in its simplest form

<b>a.</b> $\frac{1}{5} + \frac{3}{5}$	<b>b.</b> $\frac{2}{5} + \frac{1}{10}$	<b>c.</b> $\frac{3}{4} + \frac{1}{8}$	<b>d.</b> $\frac{1}{6} + \frac{2}{3}$	<b>e.</b> $\frac{1}{9} + \frac{2}{3}$
<b>f.</b> $\frac{1}{3} + \frac{1}{4}$	<b>g.</b> $\frac{3}{5} + \frac{1}{4}$	<b>h.</b> $\frac{1}{4} + \frac{1}{6}$	<b>i.</b> $\frac{1}{3} + \frac{5}{8}$	<b>j.</b> $\frac{1}{2} + \frac{2}{5}$
<b>k.</b> $\frac{3}{4} + \frac{1}{6}$	<b>l.</b> $\frac{1}{2} + \frac{3}{7}$	<b>m.</b> $\frac{2}{7} + \frac{1}{8}$	<b>n.</b> $\frac{1}{5} + \frac{3}{8}$	<b>o.</b> $\frac{2}{9} + \frac{3}{7}$

**Q2.** Express each difference as a fraction in its simplest form

<b>a.</b> $\frac{3}{4} - \frac{1}{4}$	<b>b.</b> $\frac{1}{2} - \frac{1}{6}$	<b>c.</b> $\frac{5}{6} - \frac{2}{3}$	<b>d.</b> $\frac{11}{12} - \frac{5}{6}$	<b>e.</b> $\frac{11}{12} - \frac{2}{3}$
<b>f.</b> $\frac{1}{2} - \frac{1}{16}$	<b>g.</b> $\frac{2}{3} - \frac{1}{4}$	<b>h.</b> $\frac{1}{2} - \frac{2}{5}$	<b>i.</b> $\frac{4}{5} - \frac{1}{2}$	<b>j.</b> $\frac{7}{8} - \frac{3}{16}$
<b>k.</b> $\frac{11}{12} - \frac{2}{3}$	<b>l.</b> $\frac{7}{12} - \frac{1}{3}$	<b>m.</b> $\frac{5}{8} - \frac{2}{5}$	<b>n.</b> $\frac{5}{6} - \frac{3}{5}$	<b>o.</b> $\frac{7}{9} - \frac{3}{7}$

**Q3.** Express each product as a fraction in its simplest form

<b>a.</b> $\frac{1}{4} \times \frac{4}{7}$	<b>b.</b> $\frac{1}{3} \times \frac{3}{10}$	<b>c.</b> $\frac{1}{2} \times \frac{4}{7}$	<b>d.</b> $\frac{2}{3} \times \frac{1}{8}$	<b>e.</b> $\frac{4}{5} \times \frac{1}{16}$
<b>f.</b> $\frac{6}{7} \times \frac{2}{3}$	<b>g.</b> $\frac{3}{5} \times \frac{10}{21}$	<b>h.</b> $\frac{3}{8} \times \frac{4}{21}$	<b>i.</b> $\frac{21}{32} \times \frac{4}{7}$	<b>j.</b> $\frac{1}{9} \times \frac{12}{13}$
<b>k.</b> $\frac{5}{16} \times \frac{6}{25}$	<b>l.</b> $\frac{5}{7} \times \frac{14}{15}$	<b>m.</b> $\frac{7}{9} \times \frac{12}{35}$	<b>n.</b> $\frac{12}{13} \times \frac{39}{48}$	<b>o.</b> $\frac{2}{3} \times \frac{5}{9}$

**Q4.** Express as a single fraction

<b>a.</b> $\frac{1}{4} \div \frac{1}{3}$	<b>b.</b> $\frac{2}{5} \div \frac{2}{7}$	<b>c.</b> $\frac{4}{5} \div \frac{3}{4}$	<b>d.</b> $\frac{3}{7} \div \frac{2}{5}$	<b>e.</b> $\frac{5}{12} \div \frac{5}{3}$
<b>f.</b> $\frac{5}{9} \div \frac{1}{3}$	<b>g.</b> $\frac{2}{5} \div \frac{9}{10}$	<b>h.</b> $\frac{3}{7} \div \frac{11}{14}$	<b>i.</b> $\frac{4}{9} \div \frac{2}{3}$	<b>j.</b> $\frac{2}{5} \div \frac{4}{5}$
<b>k.</b> $\frac{24}{35} \div \frac{20}{21}$	<b>l.</b> $\frac{6}{25} \div \frac{9}{20}$	<b>m.</b> $\frac{8}{21} \div \frac{9}{14}$	<b>n.</b> $\frac{10}{21} \div \frac{8}{9}$	<b>o.</b> $\frac{20}{33} \div \frac{15}{44}$

**Q5.** Express each sum as a fraction in its simplest form

a.	$\frac{a}{5} + \frac{a}{5}$	b.	$\frac{2b}{5} + \frac{b}{10}$	c.	$\frac{3x}{4} + \frac{x}{8}$	d.	$\frac{p}{6} + \frac{2p}{3}$	e.	$\frac{y}{9} + \frac{2y}{3}$
f.	$\frac{3}{m} + \frac{2}{m}$	g.	$\frac{5}{x} + \frac{1}{x}$	h.	$\frac{2}{a} + \frac{5}{2a}$	i.	$\frac{4}{3y} + \frac{3}{y}$	j.	$\frac{8}{p} + \frac{3}{5p}$
k.	$\frac{3}{a} + \frac{2}{b}$	l.	$\frac{5}{x} + \frac{3}{y}$	m.	$\frac{2}{m} + \frac{7}{n}$	n.	$\frac{4}{p} + \frac{3}{q}$	o.	$\frac{9}{c} + \frac{7}{d}$
p.	$\frac{3}{2x} + \frac{2}{3y}$	q.	$\frac{4}{3a} + \frac{5}{2b}$	r.	$\frac{2}{3a} + \frac{9}{3b}$	s.	$\frac{5}{4m} + \frac{3}{2n}$	t.	$\frac{7}{3p} + \frac{2}{6q}$
u.	$\frac{1}{a} + \frac{2}{a^2}$	v.	$\frac{5}{x^2} + \frac{3}{x}$	w.	$\frac{3}{3b} + \frac{4}{b^2}$	x.	$\frac{7}{2p^2} + \frac{4}{3p}$	y.	$\frac{8}{2m} + \frac{5}{3m^2}$

**Q6.** Express each difference as a fraction in its simplest form

a.	$\frac{3a}{5} - \frac{a}{5}$	b.	$\frac{2b}{5} - \frac{b}{10}$	c.	$\frac{3x}{4} - \frac{x}{8}$	d.	$\frac{5p}{6} - \frac{2p}{3}$	e.	$\frac{8y}{9} - \frac{2y}{3}$
f.	$\frac{5}{m} - \frac{2}{m}$	g.	$\frac{7}{x} - \frac{3}{x}$	h.	$\frac{5}{a} - \frac{1}{2a}$	i.	$\frac{8}{3y} - \frac{2}{y}$	j.	$\frac{8}{p} - \frac{3}{5p}$
k.	$\frac{3}{a} - \frac{2}{b}$	l.	$\frac{5}{x} - \frac{3}{y}$	m.	$\frac{7}{m} - \frac{2}{n}$	n.	$\frac{4}{p} - \frac{3}{q}$	o.	$\frac{9}{c} - \frac{7}{d}$
p.	$\frac{3}{2x} - \frac{2}{3y}$	q.	$\frac{5}{3a} - \frac{3}{2b}$	r.	$\frac{5}{3a} - \frac{2}{3b}$	s.	$\frac{5}{4m} - \frac{3}{2n}$	t.	$\frac{7}{3p} - \frac{2}{6q}$
u.	$\frac{1}{a} - \frac{2}{a^2}$	v.	$\frac{7}{x^2} - \frac{3}{x}$	w.	$\frac{4}{3b} - \frac{3}{b^2}$	x.	$\frac{7}{2p^2} - \frac{4}{3p}$	y.	$\frac{8}{2m} - \frac{5}{3m^2}$

**Q7.** Express each product as a fraction in its simplest form

a.	$\frac{x}{3} \times \frac{x}{6}$	b.	$\frac{y}{2} \times \frac{y}{4}$	c.	$\frac{a}{2} \times \frac{b}{7}$	d.	$\frac{p}{3} \times \frac{q}{8}$	e.	$\frac{c^2}{5} \times \frac{c}{6}$
f.	$\frac{6}{a} \times \frac{2}{a}$	g.	$\frac{3}{x} \times \frac{10}{y}$	h.	$\frac{3}{p} \times \frac{4}{p}$	i.	$\frac{2}{3m} \times \frac{4}{5m}$	j.	$\frac{1}{b} \times \frac{11}{3c}$

**Q7.** (continued)

**k.**  $\frac{5m}{6} \times \frac{3}{2m}$

**l.**  $\frac{5}{7x} \times \frac{4x}{3}$

**m.**  $\frac{2y}{9} \times \frac{12}{5y^2}$

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

**o.**  $\frac{5}{3p} \times \frac{2}{p^3}$

**p.**  $\frac{3t^2}{5s} \times \frac{2s^2}{6t^3}$

**q.**  $\frac{5pq}{2} \times \frac{3}{4pq^2}$

**r.**  $\frac{7ab^2}{6c} \times \frac{2c^3}{3a^2}$

**s.**  $\frac{4}{5mn} \times \frac{2m^4}{n^2}$

**t.**  $\frac{4yz}{9x} \times \frac{3xz}{2y^3}$

**u.**  $\frac{5ab^3}{3c} \times \frac{3a}{2bc^2}$

**v.**  $\frac{2cd}{7a} \times \frac{3a^2}{4cd^2}$

**w.**  $\frac{10xy^2}{3} \times \frac{12xy}{5y^2}$

**x.**  $\frac{3}{8s^3} \times \frac{4st}{t^3}$

**y.**  $\frac{4pq^2}{3a} \times \frac{6a^2}{5p^3}$

**z.**  $\frac{(x+1)^2}{3x^4} \times \frac{10x^2}{5x+5}$

**Q8.** Express as a single fraction

**a.**  $\frac{a}{4} \div \frac{a}{2}$

**b.**  $\frac{x}{2} \div \frac{y}{2}$

**c.**  $\frac{ab}{5} \div \frac{a}{2}$

**d.**  $\frac{p^2}{10} \div \frac{p}{5}$

**e.**  $\frac{2c}{3} \div \frac{c^2}{6}$

**f.**  $\frac{3}{t} \div \frac{6}{t}$

**g.**  $\frac{2}{k} \div \frac{4}{m}$

**h.**  $\frac{3}{y} \div \frac{9}{y^2}$

**i.**  $\frac{4}{bc} \div \frac{2}{c}$

**j.**  $\frac{3}{2x} \div \frac{12}{x^2}$

**k.**  $\frac{24xy}{35z} \div \frac{20xy}{21z}$

**l.**  $\frac{6q^2}{25p} \div \frac{9q}{20p^2}$

**m.**  $\frac{8ab}{21c} \div \frac{9b}{14ac}$

**n.**  $\frac{10m}{21n^2} \div \frac{8mn}{9}$

**o.**  $\frac{20ax}{33y} \div \frac{15x}{44ay^2}$

**p.**  $\frac{5st}{9v} \div \frac{t}{3v^3}$

**q.**  $\frac{2a^2}{5mn} \div \frac{9a}{10m^4}$

**r.**  $\frac{3pqr}{7} \div \frac{11pq^3}{14r}$

**s.**  $\frac{4dx}{9y^4} \div \frac{2x^3}{3d^2}$

**t.**  $\frac{16de}{21f^2} \div \frac{8e}{9df}$

## Algebraic Operations 2 ~ Formulae

**Q1.** Change the subject of each formula to  $x$ .

**a.**  $y = x + 3$

**b.**  $y = x - 5$

**c.**  $y = x + a$

**d.**  $y = x - b$

**e.**  $y = 3x$

**f.**  $y = 10x$

**g.**  $y = kx$

**h.**  $y = ax$

**i.**  $y = 3p + x$

**j.**  $y = x - 5t$

**k.**  $y = 2x + 1$

**l.**  $y = 3x - 7$

**m.**  $y = 7x + 4a$

**n.**  $y = 3b + 4x$

**o.**  $y = 8 + 10x$

**Q2.** Make  $a$  the subject of each formula.

**a.**  $b = 4 - a$

**b.**  $d = 12 - a$

**c.**  $y = 5x - a$

**d.**  $m = 2 - 2a$

**e.**  $q = 7 - 5a$

**f.**  $c = 20 - 3a$

**g.**  $r = s - 2a$

**h.**  $t = d - 4a$

**i.**  $z = 4b - 5a$

**j.**  $k = 2h - 7a$

**k.**  $p = 6q - 11a$

**l.**  $g = 2x - 9a$

**Q3.** Change the subject of the formula to  $x$ .

**a.**  $y = ax + b$

**b.**  $y = mx + c$

**c.**  $t = sx - r$

**d.**  $p = qx + 2r$

**e.**  $m = fx - 3n$

**f.**  $a = b + cx$

**g.**  $k = h - mx$

**h.**  $d = 3b + cx$

**i.**  $g = kc - hx$

**Q4.** Change the subject of each formula to the letter shown in brackets.

**a.**  $P = 4l$  ( $l$ )

**b.**  $V = IR$  ( $I$ )

**c.**  $S = DT$  ( $T$ )

**d.**  $A = lb$  ( $b$ )

**e.**  $C = \pi d$  ( $d$ )

**f.**  $G = UT$  ( $U$ )

**g.**  $v = u + at$  ( $t$ )

**h.**  $P = 2l + 2b$  ( $l$ )

**i.**  $H = xy + 5m$  ( $y$ )

**Q5.** Change the subject of each formula to  $c$ .

**a.**  $b = \frac{1}{2}c$

**b.**  $x = \frac{1}{5}c$

**c.**  $y = \frac{1}{4}c$

**d.**  $m = \frac{1}{6}c$

**e.**  $k = \frac{1}{9}c$

**f.**  $d = \frac{1}{10}c$

**g.**  $a = \frac{1}{2}c + 2$

**h.**  $h = \frac{1}{3}c - 5$

**i.**  $p = \frac{1}{4}c + q$

**j.**  $y = \frac{1}{10}c - x$

**k.**  $t = \frac{1}{8}c + 2s$

**l.**  $r = \frac{1}{5}c - 3q$

**Q6.** Make  $x$  the subject of each formula.

**a.**  $y = \frac{3}{x}$

**b.**  $d = \frac{c}{x}$

**c.**  $m = \frac{y}{x}$

**d.**  $s = \frac{a+2}{x}$

**e.**  $w = \frac{z-1}{x}$

**f.**  $a = \frac{b+c}{x}$

**g.**  $a = \frac{x+8}{9}$

**h.**  $k = \frac{x-5}{2}$

**i.**  $p = \frac{3-x}{4}$

**j.**  $y = \frac{2}{x} + 1$

**k.**  $z = \frac{6}{x} - 7$

**l.**  $h = \frac{m}{x} + k$

**Q7.** Change the subject of each formula to  $k$ .

**a.**  $y = \sqrt{k}$

**b.**  $x = \sqrt{k}$

**c.**  $m = \sqrt{k}$

**d.**  $a = \sqrt{\frac{k}{b}}$

**e.**  $c = \sqrt{\frac{k}{d}}$

**f.**  $h = \sqrt{\frac{k}{g}}$

**g.**  $s = \sqrt{\frac{t}{k}}$

**h.**  $q = \sqrt{\frac{p}{k}}$

**i.**  $w = \sqrt{\frac{z}{k}}$

**j.**  $r = k^2$

**k.**  $ab = k^2$

**l.**  $\frac{p}{q} = k^2$

**m.**  $y = x + k^2$

**n.**  $c = k^2 - d$

**o.**  $x = 3k^2 - 1$

**Q8.** Change the subject of each formula to the letter shown in brackets.

**a.**  $v^2 = u^2 + 2as$  (s)

**b.**  $v^2 = u^2 + 2as$  (u)

**c.**  $V = \pi r^2 h$  (h)

**d.**  $V = \pi r^2 h$  (r)

**e.**  $R = \sqrt{\frac{A}{\pi}}$  (A)

**f.**  $L = 3 + \sqrt{6a}$  (a)

**g.**  $2k = \sqrt{(p+4)}$  (p)

**h.**  $x^2 = \frac{4yz}{t}$  (y)

**i.**  $ar = \frac{1}{2} \sqrt{\frac{x}{b}}$  (b)

**j.**  $st = A^2(x-3y)$  (A)

**k.**  $R = A^2(x-3y)$  (x)

**l.**  $na = \sqrt{(1-n^2)}$  (n)

**m.**  $d = \frac{t(n-1)}{n}$  (n)

**n.**  $\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$  (R)

**o.**  $d = \frac{a^2(x+b)}{4}$  (a)

## Algebraic Operations 3 ~ Surds

**Q1.** Simplify :

- |                 |                |                  |                 |                  |                  |
|-----------------|----------------|------------------|-----------------|------------------|------------------|
| a. $\sqrt{20}$  | b. $\sqrt{12}$ | c. $\sqrt{8}$    | d. $\sqrt{90}$  | e. $\sqrt{18}$   | f. $\sqrt{28}$   |
| g. $\sqrt{45}$  | h. $\sqrt{24}$ | i. $\sqrt{80}$   | j. $\sqrt{72}$  | k. $\sqrt{300}$  | l. $\sqrt{32}$   |
| m. $\sqrt{160}$ | n. $\sqrt{27}$ | o. $\sqrt{150}$  | p. $\sqrt{44}$  | q. $\sqrt{63}$   | r. $\sqrt{50}$   |
| s. $\sqrt{175}$ | t. $\sqrt{60}$ | u. $\sqrt{1200}$ | v. $\sqrt{224}$ | w. $10\sqrt{48}$ | x. $2\sqrt{108}$ |

**Q2.** Express each of the following in its simplest form.

- |                              |                                       |                                       |  |
|------------------------------|---------------------------------------|---------------------------------------|--|
| a. $4\sqrt{3} + 5\sqrt{3}$   | b. $8\sqrt{6} - 2\sqrt{6}$            | c. $\sqrt{2} + 2\sqrt{2}$             | d. $3\sqrt{7} - 9\sqrt{7}$               |
| e. $5\sqrt{10} - 5\sqrt{10}$ | f. $\sqrt{5} + 5\sqrt{5} - 3\sqrt{5}$ | g. $2\sqrt{3} + \sqrt{3} - 5\sqrt{3}$ | h. $5\sqrt{11} + 7\sqrt{11} - \sqrt{11}$ |

**Q3.** Express each of the following in its simplest form.

- |                            |                            |                             |                              |
|----------------------------|----------------------------|-----------------------------|------------------------------|
| a. $\sqrt{12} + \sqrt{27}$ | b. $\sqrt{32} - \sqrt{8}$  | c. $\sqrt{72} - \sqrt{50}$  | d. $\sqrt{2} + \sqrt{98}$    |
| e. $\sqrt{80} + \sqrt{20}$ | f. $\sqrt{24} + \sqrt{54}$ | g. $\sqrt{180} - \sqrt{45}$ | h. $\sqrt{1000} - \sqrt{90}$ |

**Q4.** Simplify :

- |                                |                                |                                 |                                 |
|--------------------------------|--------------------------------|---------------------------------|---------------------------------|
| a. $\sqrt{2} \times \sqrt{2}$  | b. $\sqrt{3} \times \sqrt{3}$  | c. $\sqrt{11} \times \sqrt{11}$ | d. $\sqrt{a} \times \sqrt{a}$   |
| e. $\sqrt{5} \times \sqrt{5}$  | f. $\sqrt{c} \times \sqrt{c}$  | g. $\sqrt{6} \times \sqrt{6}$   | h. $\sqrt{k} \times \sqrt{k}$   |
| i. $\sqrt{2} \times \sqrt{8}$  | j. $\sqrt{12} \times \sqrt{3}$ | k. $\sqrt{5} \times \sqrt{20}$  | l. $\sqrt{2} \times \sqrt{32}$  |
| m. $\sqrt{a} \times \sqrt{b}$  | n. $\sqrt{10} \times \sqrt{x}$ | o. $\sqrt{p} \times \sqrt{q}$   | p. $\sqrt{k} \times \sqrt{6}$   |
| q. $\sqrt{2} \times \sqrt{10}$ | r. $\sqrt{24} \times \sqrt{3}$ | s. $\sqrt{5} \times \sqrt{10}$  | t. $\sqrt{6} \times \sqrt{12}$  |
| u. $\sqrt{6} \times \sqrt{3}$  | v. $\sqrt{20} \times \sqrt{3}$ | w. $\sqrt{4} \times \sqrt{8}$   | x. $\sqrt{15} \times \sqrt{10}$ |

**Q5.** Simplify :

- |                                  |                                   |                                  |                                   |                                  |                                    |
|----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|----------------------------------|------------------------------------|
| a. $\frac{\sqrt{8}}{\sqrt{2}}$   | b. $\frac{\sqrt{27}}{\sqrt{12}}$  | c. $\frac{\sqrt{2}}{\sqrt{32}}$  | d. $\frac{\sqrt{3}}{\sqrt{27}}$   | e. $\frac{\sqrt{20}}{\sqrt{5}}$  | f. $\frac{\sqrt{12}}{\sqrt{48}}$   |
| g. $\frac{\sqrt{54}}{\sqrt{24}}$ | h. $\frac{\sqrt{175}}{\sqrt{63}}$ | i. $\frac{\sqrt{18}}{\sqrt{72}}$ | j. $\frac{\sqrt{6}}{\sqrt{54}}$   | k. $\frac{\sqrt{288}}{\sqrt{8}}$ | l. $\frac{\sqrt{1000}}{\sqrt{90}}$ |
| m. $\frac{\sqrt{48}}{\sqrt{6}}$  | n. $\frac{\sqrt{3}}{\sqrt{24}}$   | o. $\frac{\sqrt{98}}{\sqrt{7}}$  | p. $\frac{\sqrt{50}}{\sqrt{250}}$ | q. $\frac{\sqrt{28}}{\sqrt{63}}$ | r. $\frac{\sqrt{27}}{\sqrt{63}}$   |

**Q6.** Multiply out the brackets and simplify, where possible.

- |                              |   |  |
|------------------------------|---|--|
| a. $\sqrt{3}(\sqrt{2} + 1)$  | b. $\sqrt{2}(\sqrt{8} + \sqrt{2})$              | c. $\sqrt{3}(\sqrt{2} + \sqrt{6})$                     |
| d. $\sqrt{5}(3 - \sqrt{5})$  | e. $(\sqrt{3} + \sqrt{5})(\sqrt{3} - \sqrt{5})$ | f. $(\sqrt{7} + 1)^2$                                  |
| g. $(\sqrt{6} + \sqrt{2})^2$ | h. $(\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3})$ | i. $(\sqrt{3} + \sqrt{6})^2 + (\sqrt{2} + \sqrt{8})^2$ |



**Q7.** Express each of the following with a rational denominator and simplify where possible.

a.  $\frac{1}{\sqrt{3}}$

b.  $\frac{2}{\sqrt{2}}$

c.  $\frac{1}{\sqrt{5}}$

d.  $\frac{12}{\sqrt{3}}$

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

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

g.  $\frac{10}{\sqrt{2}}$

h.  $\frac{35}{\sqrt{7}}$

i.  $\frac{8}{3\sqrt{2}}$

j.  $\frac{20}{7\sqrt{5}}$

k.  $\frac{50}{3\sqrt{10}}$

l.  $\frac{2}{\sqrt{8}}$

m.  $\frac{18}{\sqrt{27}}$

n.  $\frac{5}{\sqrt{50}}$

o.  $\frac{3}{\sqrt{20}}$

p.  $\frac{6}{\sqrt{18}}$

**Q8.** Express each of the following in its simplest form with a rational denominator.

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

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

c.  $\frac{\sqrt{8}}{\sqrt{2}}$

d.  $\frac{\sqrt{18}}{\sqrt{3}}$

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

f.  $\frac{\sqrt{2}}{\sqrt{12}}$

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

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

i.  $\frac{\sqrt{6}}{\sqrt{18}}$

j.  $\frac{\sqrt{50}}{\sqrt{10}}$

k.  $\sqrt{\frac{3}{12}}$

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

**Q9.** Simplify each of the following by multiplying the numerator and denominator by the conjugate surd.

a.  $\frac{1}{1-\sqrt{2}}$

b.  $\frac{1}{1+\sqrt{3}}$

c.  $\frac{3}{\sqrt{5}-1}$

d.  $\frac{2}{\sqrt{2}+2}$

e.  $\frac{3}{2-\sqrt{6}}$

f.  $\frac{5}{3+\sqrt{2}}$

g.  $\frac{4}{1+\sqrt{3}}$

h.  $\frac{1}{\sqrt{7}-2}$

i.  $\frac{6}{\sqrt{3}+\sqrt{2}}$

j.  $\frac{12}{\sqrt{10}-\sqrt{2}}$

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

l.  $\frac{14}{9-\sqrt{2}}$

## Algebraic Operations 4 ~ Indices

**Q1.** Write each of the following in its simplest index form.

<b>a.</b> $3^4 \times 3^2$	<b>b.</b> $2^1 \times 2^3$	<b>c.</b> $10^5 \times 10^2$	<b>d.</b> $8^3 \times 8^5$
<b>e.</b> $7^6 \times 7$	<b>f.</b> $5^4 \times 5^4$	<b>g.</b> $9^6 \times 9^2$	<b>h.</b> $6^8 \times 6^5$
<b>i.</b> $x^3 \times x^5$	<b>j.</b> $c^2 \times c^9$	<b>k.</b> $a^2 \times a^{12}$	<b>l.</b> $y^5 \times y^5$
<b>m.</b> $b^{10} \times b^{30}$	<b>n.</b> $p \times p^9$	<b>o.</b> $d^2 \times d^4$	<b>p.</b> $q^{11} \times q^9$
<b>q.</b> $t^3 \times t^7$	<b>r.</b> $f^4 \times f^3$	<b>s.</b> $k \times k^{12}$	<b>t.</b> $z^{50} \times z^{50}$
<b>u.</b> $x^{30} \times x^{50}$	<b>v.</b> $y^{19} \times y$	<b>w.</b> $a^{25} \times a^{65}$	<b>x.</b> $b^1 \times b^0$

**Q2.** Write each of the following in its simplest index form.

<b>a.</b> $2^8 \div 2^3$	<b>b.</b> $5^4 \div 5^2$	<b>c.</b> $12^9 \div 2^6$	<b>d.</b> $7^{11} \div 7^4$
<b>e.</b> $20^5 \div 20$	<b>f.</b> $8^8 \div 8^4$	<b>g.</b> $3^{18} \div 3^3$	<b>h.</b> $4^{15} \div 4^{13}$
<b>i.</b> $x^7 \div x^2$	<b>j.</b> $a^9 \div a^5$	<b>k.</b> $y^{20} \div y^{10}$	<b>l.</b> $b^4 \div b^1$
<b>m.</b> $p^{12} \div p^{11}$	<b>n.</b> $c^7 \div c^7$	<b>o.</b> $q^8 \div q^2$	<b>p.</b> $d^4 \div d$
<b>q.</b> $\frac{x^9}{x^3}$	<b>r.</b> $\frac{a^8}{a^2}$	<b>s.</b> $\frac{m^{14}}{m}$	<b>t.</b> $\frac{s^7}{s^7}$
<b>u.</b> $\frac{d^{20}}{d^{12}}$	<b>v.</b> $\frac{y^{100}}{y^{10}}$	<b>w.</b> $\frac{t^{100}}{t}$	<b>x.</b> $\frac{w^{10}}{w^0}$

**Q3.** Write each of the following in its simplest index form.

<b>a.</b> $(3^2)^4$	<b>b.</b> $(8^2)^2$	<b>c.</b> $(10^3)^2$	<b>d.</b> $(2^2)^5$
<b>e.</b> $(4^5)^3$	<b>f.</b> $(1^7)^2$	<b>g.</b> $(12^3)^3$	<b>h.</b> $(5^5)^5$
<b>i.</b> $(x^4)^2$	<b>j.</b> $(y^8)^5$	<b>k.</b> $(a^3)^7$	<b>l.</b> $(m^4)^4$
<b>m.</b> $(b^3)^6$	<b>n.</b> $(p^5)^3$	<b>o.</b> $(k^5)^{20}$	<b>p.</b> $(z^6)^0$

**Q4.** Write the following without brackets.

<b>a.</b> $(2b)^2$	<b>b.</b> $(7a)^3$	<b>c.</b> $(3x)^4$	<b>d.</b> $(2y)^5$
<b>e.</b> $(ab)^4$	<b>f.</b> $(xy)^7$	<b>g.</b> $(wz)^5$	<b>h.</b> $(st)^3$
<b>i.</b> $(pq^2)^3$	<b>j.</b> $(x^4y)^2$	<b>k.</b> $(a^2b^3)^5$	<b>l.</b> $(6a^5)^2$
<b>m.</b> $(10x^2)^3$	<b>n.</b> $(2c^4)^5$	<b>o.</b> $(3ab^2)^3$	<b>p.</b> $(4m^2k)^2$

**Q5.** Simplify these expressions.

<b>a.</b> $2a^3 \times 5a^5$	<b>b.</b> $7x \times 9x^8$	<b>c.</b> $12p^7 \div 4p^4$	<b>d.</b> $50b^{12} \div 10b^6$
<b>e.</b> $3y \times (2y^2)^3$	<b>f.</b> $(4q^3)^2 \times 5q^4$	<b>g.</b> $(4c^3)^3 \div 8c^2$	<b>h.</b> $72z^{12} \div (3z^4)^2$
<b>i.</b> $k^2(k^3 + k^5)$	<b>j.</b> $m^5(m^2 - m^3)$	<b>k.</b> $2x^4(x^3 + 3x^2)$	<b>l.</b> $5a^5(2a^2 - 3a^3)$
<b>m.</b> $\frac{x^5 \times x^4}{x^6}$	<b>n.</b> $\frac{(m^5)^4}{m^6}$	<b>o.</b> $\frac{5c^3 \times 4c^7}{2c^6}$	<b>p.</b> $\frac{(3q^3)^2 \times 4q^4}{6q^7}$
<b>q.</b> $\frac{(3xy^5)^3}{9x^2y}$	<b>r.</b> $\frac{(2a^2b^5)^6}{(4ab)^2}$	<b>s.</b> $\frac{(4p^4)^3}{2p^3 \times 8p^6}$	<b>t.</b> $\frac{(2ab^3)^5}{3a^2b \times 4ab^2}$

**Q6.** Write down the value of

a.  $5^0$       b.  $2^0$       c.  $100^0$       d.  $(-3)^0$       e.  $25^0$       f.  $\frac{1}{2}^0$   
g.  $a^0$       h.  $k^0$       i.  $(mn)^0$       j.  $(ab^2)^0$       k.  $(10x^3)^0$       l.  $(16y^2z^3)^0$

**Q7.** Rewrite the following with positive indices.

a.  $3^{-2}$       b.  $5^{-4}$       c.  $2^{-6}$       d.  $10^{-3}$       e.  $4^{-5}$       f.  $200^{-7}$   
g.  $a^{-5}$       h.  $x^{-2}$       i.  $p^{-7}$       j.  $y^{-10}$       k.  $2b^{-3}$       l.  $10q^{-x}$   
m.  $\frac{1}{x^{-3}}$       n.  $\frac{1}{w^{-5}}$       o.  $\frac{3}{a^{-2}}$       p.  $\frac{10}{c^{-8}}$       q.  $\frac{2}{3t^{-1}}$       r.  $\frac{5}{4y^{-3}}$

**Q8.** Rewrite the following with negative indices.

a.  $\frac{1}{3^2}$       b.  $\frac{1}{6^9}$       c.  $\frac{1}{5^4}$       d.  $\frac{1}{2^7}$       e.  $\frac{1}{10^3}$       f.  $\frac{1}{4^4}$   
g.  $\frac{1}{x^3}$       h.  $\frac{1}{a^5}$       i.  $\frac{1}{p^4}$       j.  $\frac{1}{y^{10}}$       k.  $\frac{1}{q^6}$       l.  $\frac{1}{c^8}$

**Q9.** Simplify the following expressions.

a.  $m^3 \times m^{-5}$       b.  $x^7 \times x^{-2}$       c.  $p^{-8} \times p^5$       d.  $a^{-3} \times a^{-5}$   
e.  $(y^3)^{-4}$       f.  $(c^{-5})^3$       g.  $(q^3)^{-5}$       h.  $(w^{-2})^{-4}$   
i.  $4b^{-4} \times 5b^5$       j.  $3x^6 \times 9x^{-6}$       k.  $4k^3 \div 2k^{-2}$       l.  $18d \div 12d^4$   
m.  $x^2(x^3 + x^{-1})$       n.  $p^{-3}(p^4 - p^{-8})$       o.  $3a^5(2a + 3a^{-2})$       p.  $\frac{1}{2}m^{-2}(4m^{-3} - 10m^6)$   
q.  $\frac{v^3 \times v^5}{v^{-2}}$       r.  $\frac{4h^7 \times 3h^{-4}}{2h^4}$       s.  $\frac{4c^{-5} \times 9c^6}{6c^{-4}}$       t.  $\frac{5x^4 \times 6x^{-8}}{3x^{-4}}$

**Q10.** Find the value of

a.  $16^{\frac{1}{4}}$       b.  $8^{\frac{1}{3}}$       c.  $36^{\frac{1}{2}}$       d.  $27^{\frac{2}{3}}$       e.  $64^{\frac{1}{3}}$       f.  $1000^{\frac{1}{3}}$   
g.  $25^{\frac{1}{2}}$       h.  $81^{\frac{3}{4}}$       i.  $125^{\frac{2}{3}}$       j.  $64^{\frac{1}{2}}$       k.  $216^{\frac{1}{3}}$       l.  $16^{\frac{1}{4}}$   
m.  $4^{-\frac{1}{2}}$       n.  $16^{-\frac{1}{2}}$       o.  $9^{-\frac{1}{2}}$       p.  $27^{-\frac{2}{3}}$       q.  $256^{-\frac{3}{4}}$       r.  $1000^{-\frac{2}{3}}$

**Q11.** Simplify the following expressions, giving your answers with positive indices.

a.  $(x^2)^6$       b.  $(p^{\frac{1}{3}})^6$       c.  $(a^{\frac{3}{4}})^8$       d.  $(y^{\frac{2}{3}})^9$       e.  $(q^{\frac{1}{5}})^{10}$       f.  $(k^{\frac{2}{5}})^{15}$   
g.  $(g^4)^{\frac{1}{2}}$       h.  $(m^{12})^{\frac{2}{3}}$       i.  $(c^9)^{\frac{2}{3}}$       j.  $(h^5)^{\frac{1}{2}}$       k.  $(z^4)^{\frac{3}{4}}$       l.  $(b^{16})^{\frac{3}{4}}$   
m.  $x^{\frac{1}{2}} \times x^{\frac{1}{2}}$       n.  $y^{\frac{1}{3}} \times y^{\frac{2}{3}}$       o.  $d^{\frac{1}{4}} \times d^{\frac{9}{4}}$       p.  $s^{\frac{7}{2}} \times s^{\frac{1}{2}}$   
q.  $3x^{\frac{1}{2}} \times 4x^{\frac{1}{2}}$       r.  $6x^{\frac{1}{2}} \times 2x^{-\frac{1}{2}}$       s.  $2x^{\frac{1}{2}} \times 5x^{\frac{1}{2}}$       t.  $3x^{\frac{2}{3}} \times 2x^{-\frac{1}{3}}$   
u.  $x^{\frac{1}{2}} \div x^{\frac{1}{2}}$       v.  $2x^{\frac{1}{2}} \div x^{-\frac{1}{2}}$       w.  $8x^{\frac{2}{3}} \div 2x^{\frac{1}{3}}$       x.  $6x^{\frac{1}{3}} \div 4x^{\frac{2}{3}}$

**Q12.** Write the following in surd form.

**a.**  $x^{\frac{1}{2}}$

**b.**  $y^{\frac{1}{3}}$

**c.**  $a^{\frac{1}{4}}$

**d.**  $y^{\frac{2}{3}}$

**e.**  $b^{\frac{3}{4}}$

**f.**  $x^{\frac{5}{3}}$

**g.**  $c^{\frac{3}{5}}$

**h.**  $a^{\frac{4}{5}}$

**i.**  $c^{\frac{1}{3}}$

**j.**  $z^{\frac{1}{2}}$

**k.**  $m^{\frac{2}{3}}$

**l.**  $k^{\frac{3}{5}}$

**m.**  $p^{\frac{4}{3}}$

**n.**  $x^{\frac{-5}{3}}$

**o.**  $w^{\frac{-4}{5}}$

**p.**  $d^{\frac{-2}{7}}$

**Q13.** Write the following in index form.

**a.**  $\sqrt{x}$

**b.**  $\sqrt[3]{a}$

**c.**  $\sqrt{y^3}$

**d.**  $\sqrt[3]{z^2}$

**e.**  $\sqrt[3]{c^2}$

**f.**  $\sqrt[4]{x^3}$

**g.**  $\sqrt[3]{p^5}$

**h.**  $\sqrt[5]{m^2}$

**i.**  $\frac{1}{\sqrt{a}}$

**j.**  $\frac{1}{\sqrt[3]{z}}$

**k.**  $\frac{1}{\sqrt[3]{x^4}}$

**l.**  $\frac{1}{\sqrt{a^5}}$

**m.**  $\frac{1}{\sqrt[3]{b^2}}$

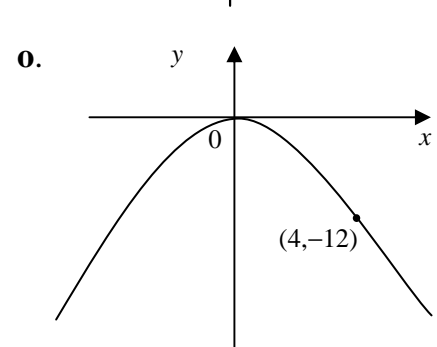
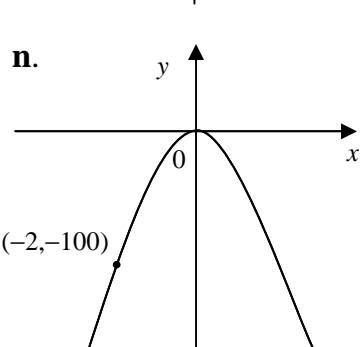
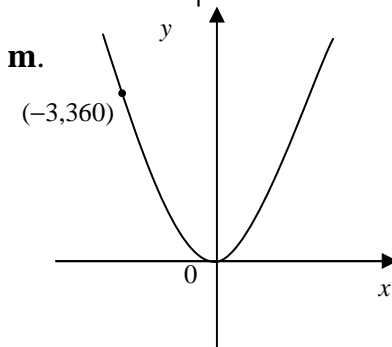
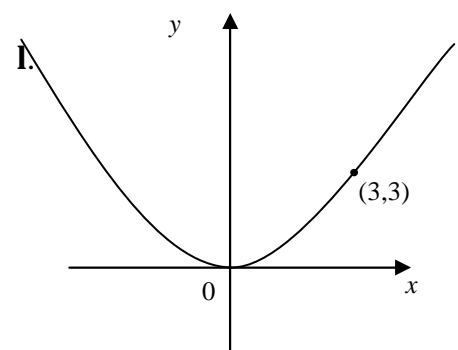
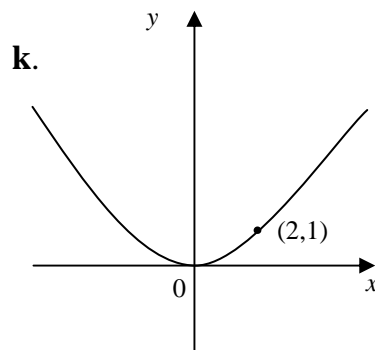
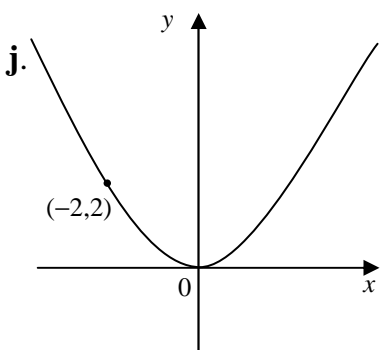
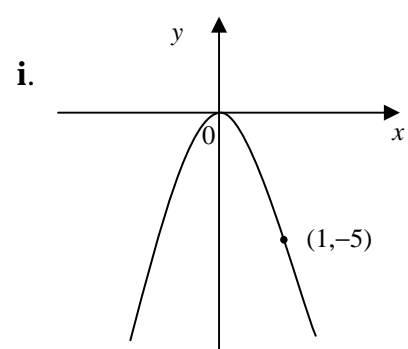
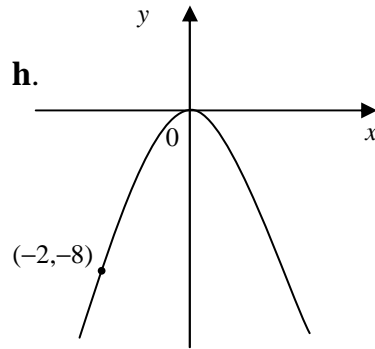
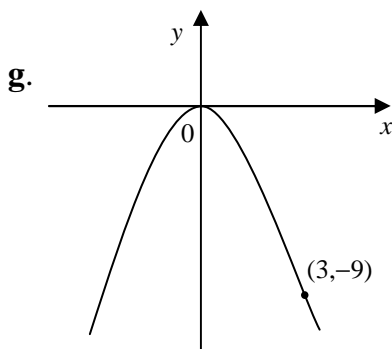
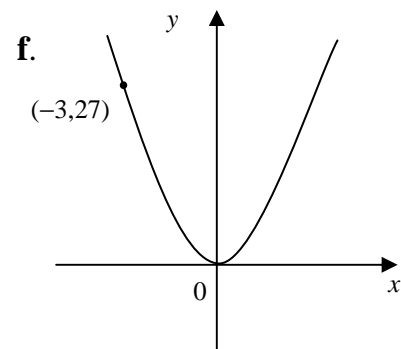
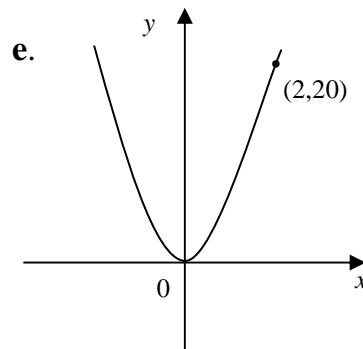
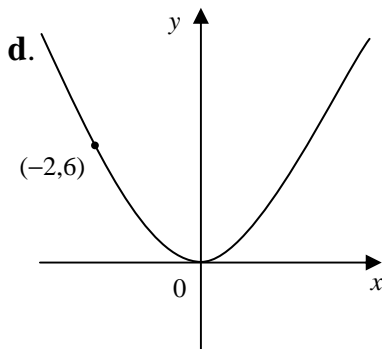
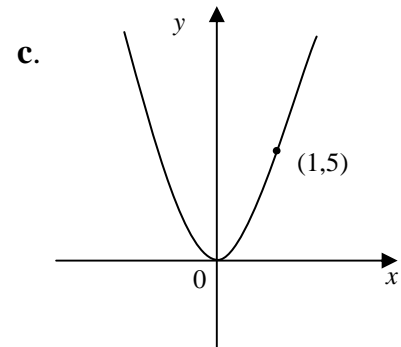
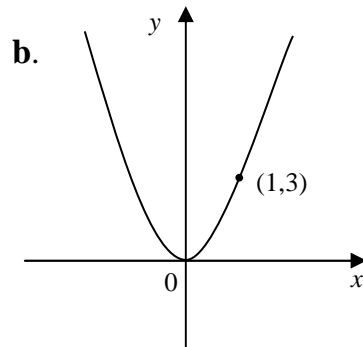
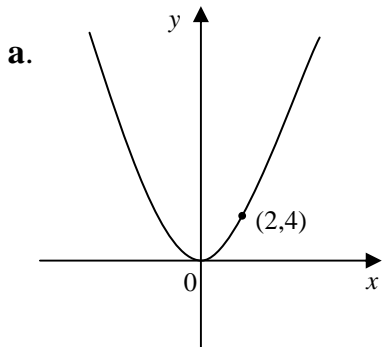
**n.**  $\frac{1}{\sqrt[5]{m^3}}$

**o.**  $\frac{1}{\sqrt[4]{y}}$

**p.**  $\frac{1}{\sqrt[3]{c^5}}$

# Quadratic Functions 1 ~ $y = ax^2$

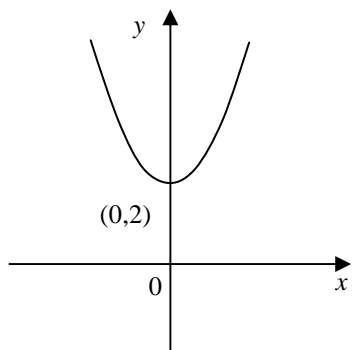
**Q1.** Write down the equation of the graphs shown below, which have the form  $y = ax^2$ .  
(Diagrams are not drawn to scale)



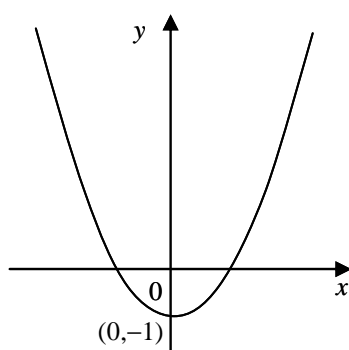
## Quadratic Functions 2 ~ $y = ax^2 + b$

**Q1.** Write down the equation of the graphs shown below, which have the form  $y = ax^2 + b$ .

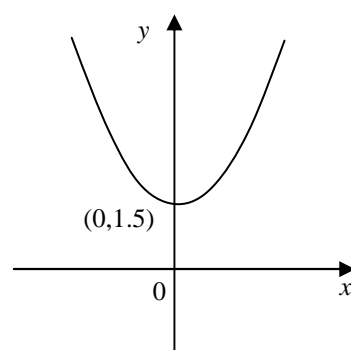
**a.**



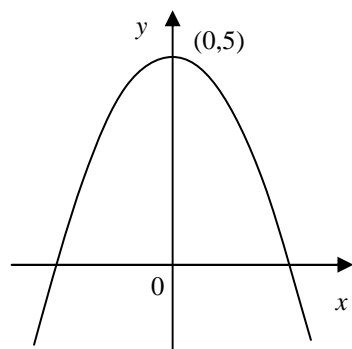
**b.**



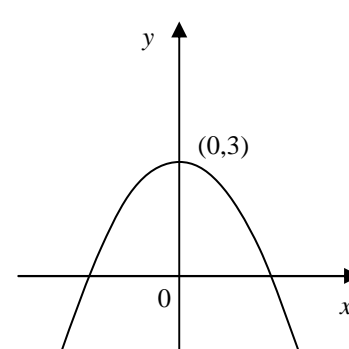
**c.**



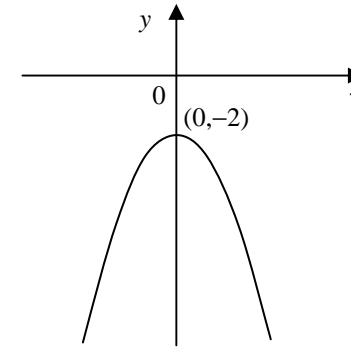
**d.**



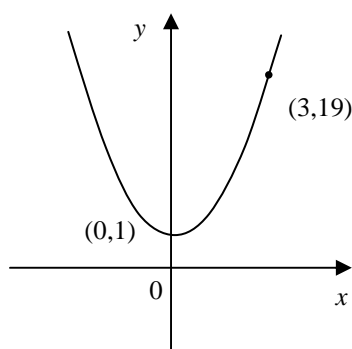
**e.**



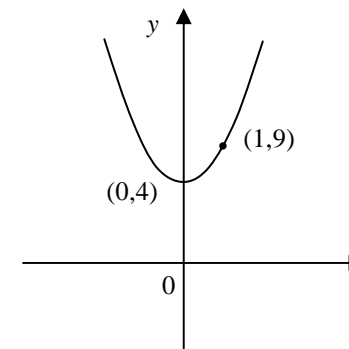
**f.**



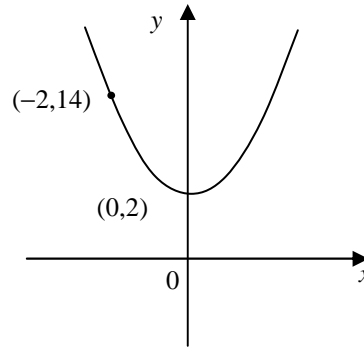
**g.**



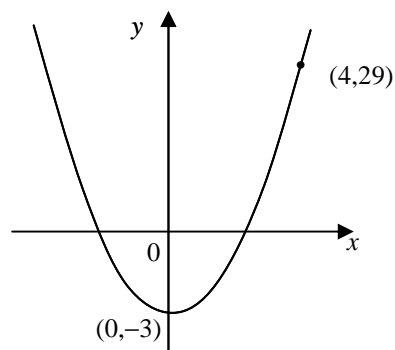
**h.**



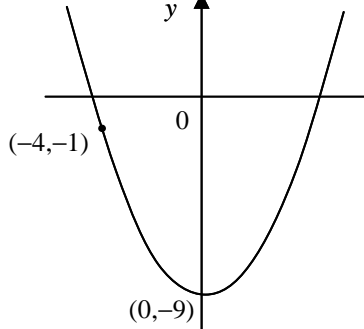
**i.**



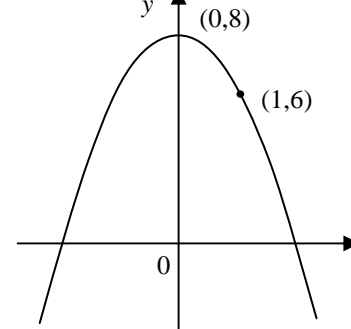
**j.**



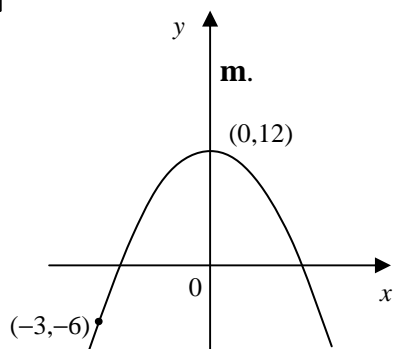
**k.**



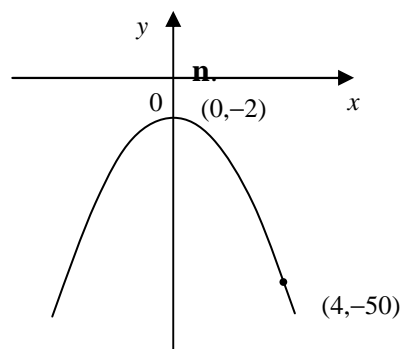
**l.**



**m.**



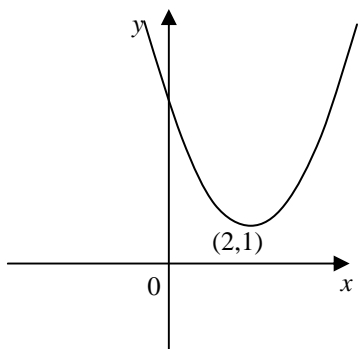
**n.**



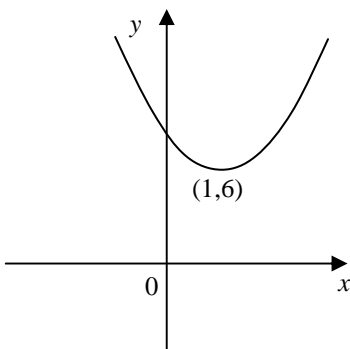
## Quadratic Functions 3 ~ $y = (x + a)^2 + b$

**Q1.** Write down the equation of the graphs shown below, which have the form  $y = (x + a)^2 + b$ .

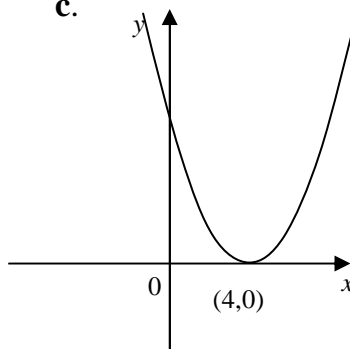
**a.**



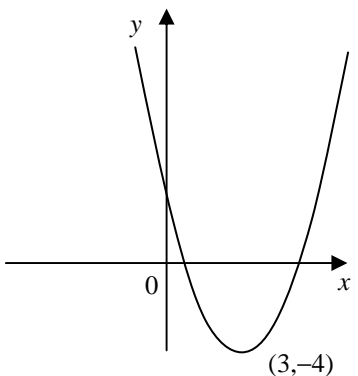
**b.**



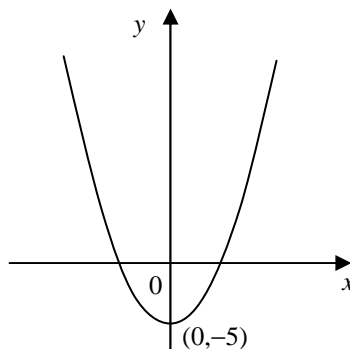
**c.**



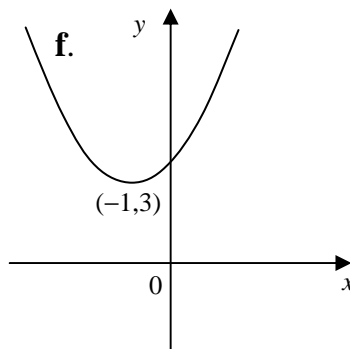
**d.**



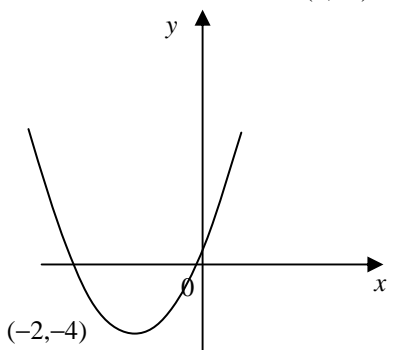
**e.**



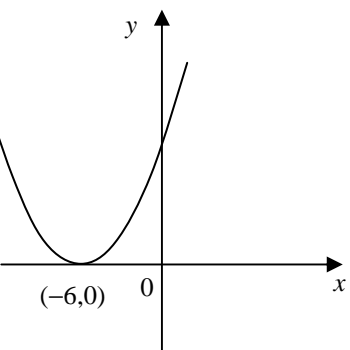
**f.**



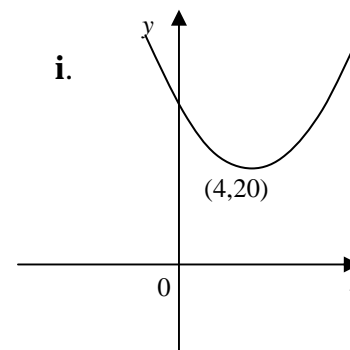
**g.**



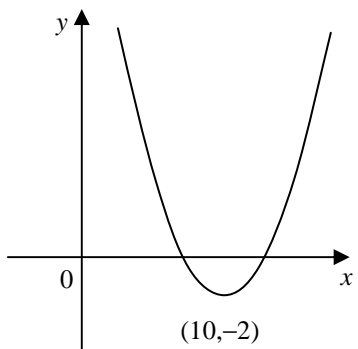
**h.**



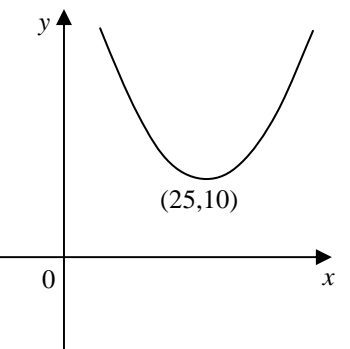
**i.**



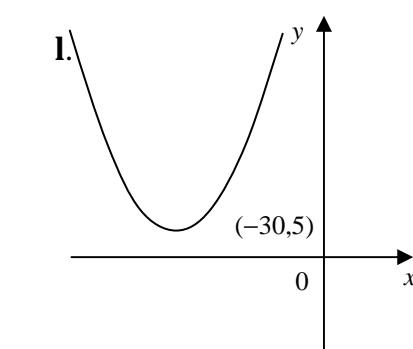
**j.**



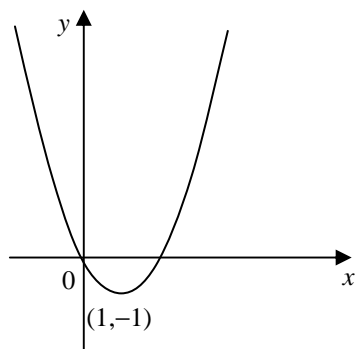
**k.**



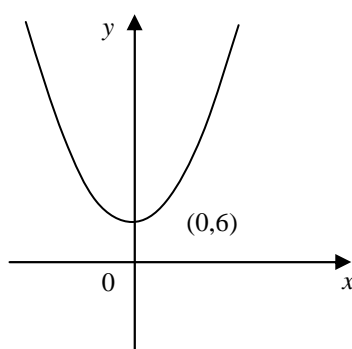
**l.**



**m.**

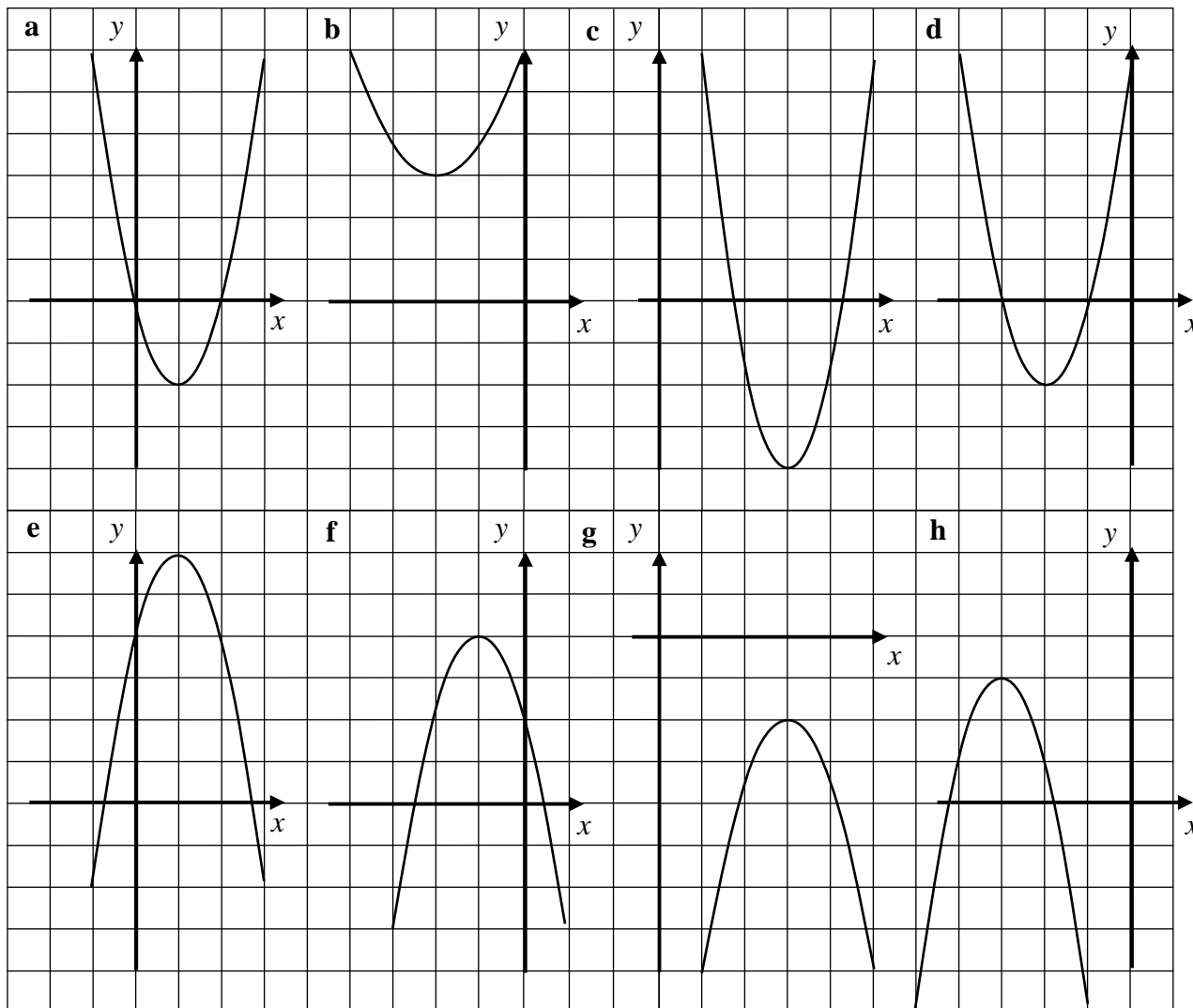


**n.**



## Quadratic Functions 4 ~ Turning Points

- Q1.** For each of the graphs below, write down
- i.** the turning point
  - ii.** its nature
  - iii.** the equation of the axis of symmetry
- and



- Q2.** For each of the equations below, write down
- i.** the turning point
  - ii.** its nature
  - iii.** the equation of the axis of symmetry
- and

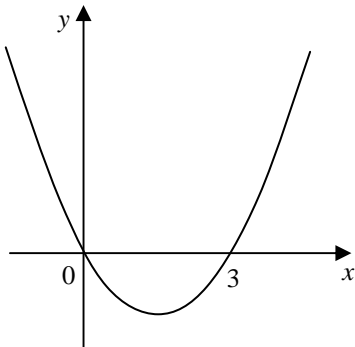
- |                                |   |                                   |
|--------------------------------|---|-----------------------------------|
| <b>a.</b> $y = (x - 4)^2 + 1$  | <b>b.</b> $y = (x - 2)^2 + 5$                     | <b>c.</b> $y = (x - 1)^2 + 7$     |
| <b>d.</b> $y = (x - 2)^2 - 3$  | <b>e.</b> $y = (x - 3)^2 - 4$                     | <b>f.</b> $y = (x - 5)^2 - 2$     |
| <b>g.</b> $y = (x + 4)^2 + 6$  | <b>h.</b> $y = (x + 1)^2 + 5$                     | <b>i.</b> $y = (x + 8)^2 + 1$     |
| <b>j.</b> $y = (x + 3)^2 - 1$  | <b>k.</b> $y = (x + \frac{1}{2})^2 - \frac{3}{4}$ | <b>l.</b> $y = (x + 0.5)^2 - 2.5$ |
| <b>m.</b> $y = -(x - 1)^2 + 4$ | <b>n.</b> $y = -(x + 6)^2 + 3$                    | <b>o.</b> $y = -(x + 7)^2 - 2$    |
| <b>p.</b> $y = (2 - x)^2 + 12$ | <b>q.</b> $y = (5 - x)^2 - 1$                     | <b>r.</b> $y = (4 - x)^2 + 3.75$  |



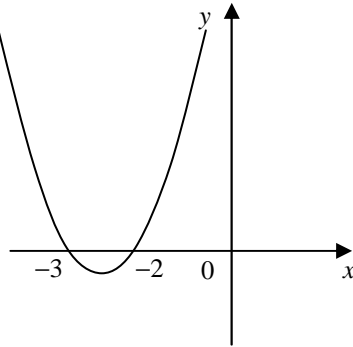
## Quadratic Equations 1 ~ Graphs

**Q1.** Use the sketches below to solve the quadratic equations.

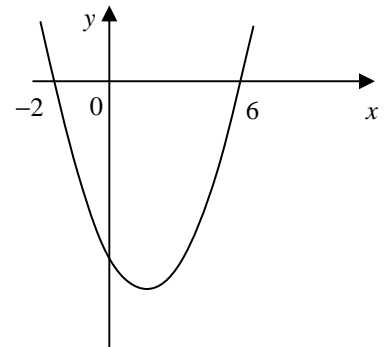
**a.**  $x^2 - 3x = 0$



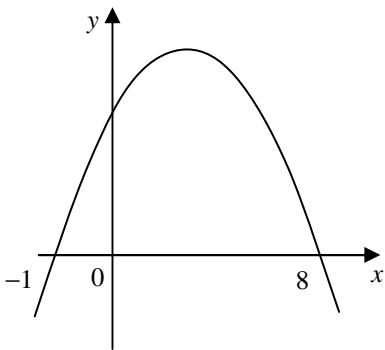
**b.**  $x^2 + 5x + 6 = 0$



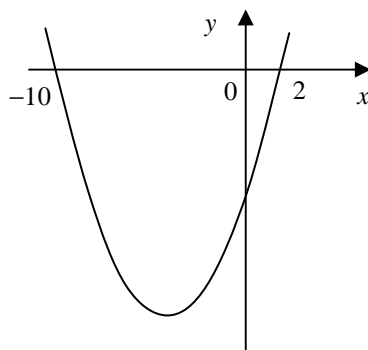
**c.**  $x^2 - 4x - 12 = 0$



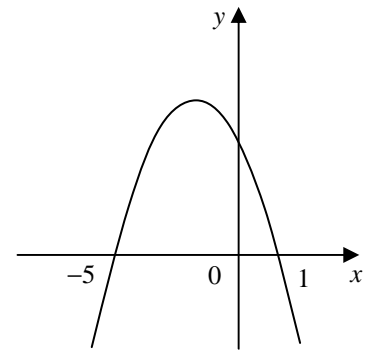
**d.**  $8 + 7x - x^2 = 0$



**e.**  $x^2 + 8x - 20 = 0$



**f.**  $5 - 4x - x^2 = 0$



**Q2. i.** Copy and complete the tables below.

**ii.** Make a sketch of the graph.

**iii.** Write down the roots of the quadratic equation  $y = 0$ .

**a.**  $y = x^2 - 2x$

x	-2	-1	0	1	2	3	4
y							

**b.**  $y = x^2 - 6x + 5$

x	0	1	2	3	4	5	6
y							

**c.**  $y = x^2 + 4x + 3$

x	-5	-4	-3	-2	-1	0	1
y							

**d.**  $y = 8 - 2x - x^2$

x	-4	-3	-2	-1	0	1	2
y							

**Q3.** For each equation, draw a suitable sketch and find the roots.

**a.**  $x^2 - 4x = 0$

**b.**  $x^2 + 6x = 0$

**c.**  $x^2 - 5x = 0$

**d.**  $x^2 - 8x + 15 = 0$

**e.**  $x^2 + 6x + 9 = 0$

**f.**  $x^2 - 4x + 4 = 0$

**g.**  $x^2 + 6x + 8 = 0$

**h.**  $x^2 + 8x + 12 = 0$

**i.**  $x^2 - 7x + 10 = 0$

**j.**  $x^2 - 5x + 4 = 0$

**k.**  $x^2 + x - 6 = 0$

**l.**  $x^2 - x - 2 = 0$

**m.**  $12 - 4x - x^2 = 0$

**n.**  $5 + 4x - x^2 = 0$

**o.**  $2 - x - x^2 = 0$

## Quadratic Equations 2 ~ Factors

**Q1.** Solve these quadratic equations, which are already in factorised form.

a.	$x(x - 5) = 0$	b.	$x(x + 7) = 0$	c.	$x(x - 1) = 0$
d.	$2b(b - 3) = 0$	e.	$3a(a + 1) = 0$	f.	$5m(m - 2) = 0$
g.	$(a - 4)(a - 2) = 0$	h.	$(y - 3)(y - 4) = 0$	i.	$(c - 5)(c - 3) = 0$
j.	$(w + 1)(w + 2) = 0$	k.	$(s + 5)(s + 4) = 0$	l.	$(z + 7)(z + 8) = 0$
m.	$(x + 3)(x - 1) = 0$	n.	$(t + 2)(t - 12) = 0$	o.	$(y + 1)(y - 9) = 0$
p.	$(a - 4)(a + 4) = 0$	q.	$(p - 7)(p + 7) = 0$	r.	$(c - 5)(c + 5) = 0$
s.	$(d - 4)(2d - 1) = 0$	t.	$(2x + 3)(x + 2) = 0$	u.	$(3s + 1)(2s - 5) = 0$

**Q2.** Solve these quadratic equations by factorising first.

a.	$x^2 + 4x = 0$	b.	$c^2 - 2c = 0$	c.	$y^2 + 8y = 0$
d.	$p^2 - p = 0$	e.	$z^2 + z = 0$	f.	$n^2 + 7n = 0$
g.	$2t^2 + 4t = 0$	h.	$5x^2 - 20x = 0$	i.	$6b^2 - 18b = 0$
j.	$4y^2 - 6y = 0$	k.	$6a^2 + 9a = 0$	l.	$14x^2 + 21x = 0$
m.	$5x - x^2 = 0$	n.	$9b - b^2 = 0$	o.	$2m - m^2 = 0$
p.	$6w - 4w^2 = 0$	q.	$9c - 12c^2 = 0$	r.	$4y - 10y^2 = 0$

**Q3.** Solve these quadratic equations by factorising first.

a.	$x^2 - 25 = 0$	b.	$b^2 - 1 = 0$	c.	$y^2 - 4 = 0$
d.	$a^2 - 36 = 0$	e.	$z^2 - 9 = 0$	f.	$k^2 - 64 = 0$
g.	$x^2 - 16 = 0$	h.	$p^2 - 144 = 0$	i.	$m^2 - 100 = 0$
j.	$t^2 - 49 = 0$	k.	$a^2 - 81 = 0$	l.	$s^2 - 121 = 0$
m.	$w^2 - 0.25 = 0$	n.	$x^2 - 6.25 = 0$	o.	$h^2 - 1.96 = 0$
p.	$2a^2 - 18 = 0$	q.	$5c^2 - 80 = 0$	r.	$4y^2 - 64 = 0$

**Q4.** Solve these quadratic equations by factorising first.

a.	$x^2 + 4x + 3 = 0$	b.	$y^2 + 6y + 5 = 0$	c.	$a^2 + 8a + 7 = 0$
d.	$m^2 + 5m + 6 = 0$	e.	$c^2 + 6c + 8 = 0$	f.	$z^2 + 7z + 12 = 0$
g.	$p^2 - 8p + 15 = 0$	h.	$b^2 - 8b + 16 = 0$	i.	$x^2 - 7x + 10 = 0$
j.	$w^2 - 12w + 27 = 0$	k.	$y^2 - 11y + 18 = 0$	l.	$k^2 - 10k + 24 = 0$
m.	$x^2 + 2x - 8 = 0$	n.	$m^2 - m - 6 = 0$	o.	$t^2 - 7t - 30 = 0$
p.	$a^2 + 5a - 14 = 0$	q.	$c^2 - 2c - 15 = 0$	r.	$p^2 + 4p - 12 = 0$

**Q5.** Solve these quadratic equations by factorising first.

a.	$2x^2 + 7x + 5 = 0$	b.	$2p^2 + 11p + 5 = 0$	c.	$3t^2 + 10t + 3 = 0$
d.	$3k^2 + 7k + 2 = 0$	e.	$3y^2 + 8y + 5 = 0$	f.	$5a^2 + 13a + 6 = 0$
g.	$2w^2 - 7w + 3 = 0$	h.	$3d^2 - 5d + 2 = 0$	i.	$5x^2 - 16x + 3 = 0$
j.	$3m^2 - 14m + 8 = 0$	k.	$2c^2 - 9c + 7 = 0$	l.	$6y^2 - 7y + 1 = 0$
m.	$3x^2 - 2x - 1 = 0$	n.	$4q^2 + 5q - 6 = 0$	o.	$4t^2 - 4t - 3 = 0$
p.	$3m^2 + 2m - 5 = 0$	q.	$36v^2 + v - 2 = 0$	r.	$7s^2 - 27s - 4 = 0$

## Quadratic Equations 3 ~ Formula

**Q1.** Solve these equations using the quadratic formula.

<b>a.</b>	$3x^2 + 7x + 2 = 0$	<b>b.</b>	$2a^2 + 5a + 2 = 0$	<b>c.</b>	$3c^2 + 8c + 5 = 0$
<b>d.</b>	$2p^2 + 11p + 9 = 0$	<b>e.</b>	$2y^2 + 11y + 5 = 0$	<b>f.</b>	$3d^2 + 11d + 6 = 0$
<b>g.</b>	$2x^2 - 7x + 3 = 0$	<b>h.</b>	$2a^2 - 5a + 3 = 0$	<b>i.</b>	$5p^2 - 17p + 6 = 0$
<b>j.</b>	$5b^2 - 7b + 2 = 0$	<b>k.</b>	$6x^2 - 7x + 2 = 0$	<b>l.</b>	$4y^2 - 11y + 6 = 0$
<b>m.</b>	$3x^2 - 2x - 1 = 0$	<b>n.</b>	$2a^2 - a - 3 = 0$	<b>o.</b>	$4p^2 - 4p - 3 = 0$
<b>p.</b>	$2c^2 + 7c - 4 = 0$	<b>q.</b>	$6y^2 - 11y - 2 = 0$	<b>r.</b>	$3w^2 + 10w - 8 = 0$

**Q2.** Solve these equations using the quadratic formula, giving your answers correct to 2 decimal places.

<b>a.</b>	$x^2 + 5x + 5 = 0$	<b>b.</b>	$b^2 + 9b + 2 = 0$	<b>c.</b>	$p^2 + 4p + 1 = 0$
<b>d.</b>	$c^2 + 4c + 2 = 0$	<b>e.</b>	$y^2 + 7y + 3 = 0$	<b>f.</b>	$a^2 + 8a + 5 = 0$
<b>g.</b>	$z^2 - 5z + 1 = 0$	<b>h.</b>	$q^2 - 12q + 4 = 0$	<b>i.</b>	$w^2 - 6w + 2 = 0$
<b>j.</b>	$d^2 - 10d + 8 = 0$	<b>k.</b>	$x^2 - 3x + 1 = 0$	<b>l.</b>	$m^2 - 7m + 4 = 0$
<b>m.</b>	$y^2 + 8y - 3 = 0$	<b>n.</b>	$k^2 + 4k - 6 = 0$	<b>o.</b>	$c^2 + 2c - 9 = 0$
<b>p.</b>	$t^2 + t - 8 = 0$	<b>q.</b>	$a^2 + 3a - 7 = 0$	<b>r.</b>	$z^2 + 5z - 10 = 0$

**Q3.** Solve these equations using the quadratic formula, giving your answers correct to 2 decimal places.

<b>a.</b>	$3x^2 + 8x + 5 = 0$	<b>b.</b>	$2b^2 + 9b + 3 = 0$	<b>c.</b>	$2p^2 + 5p + 1 = 0$
<b>d.</b>	$4c^2 + 6c + 1 = 0$	<b>e.</b>	$3y^2 + 7y + 3 = 0$	<b>f.</b>	$5a^2 + 9a + 2 = 0$
<b>g.</b>	$8z^2 - 7z + 1 = 0$	<b>h.</b>	$4q^2 - 12q + 3 = 0$	<b>i.</b>	$3w^2 - 6w + 2 = 0$
<b>j.</b>	$5d^2 - 10d + 4 = 0$	<b>k.</b>	$5x^2 - 7x + 1 = 0$	<b>l.</b>	$2m^2 - 8m + 3 = 0$
<b>m.</b>	$5y^2 + 8y - 2 = 0$	<b>n.</b>	$6k^2 + 2k - 5 = 0$	<b>o.</b>	$10c^2 + 2c - 1 = 0$
<b>p.</b>	$4t^2 + 9t - 8 = 0$	<b>q.</b>	$7a^2 + 3a - 3 = 0$	<b>r.</b>	$2z^2 + 2z - 9 = 0$

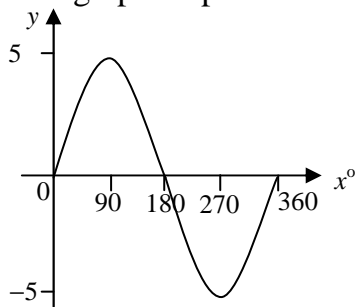
**Q4.** Solve these equations using the quadratic formula, giving your answers correct to 3 significant figures.

<b>a.</b>	$x^2 + 5x + 3 = 0$	<b>b.</b>	$c^2 + 3c + 1 = 0$	<b>c.</b>	$m^2 + 8m + 2 = 0$
<b>d.</b>	$y^2 + 7y + 7 = 0$	<b>e.</b>	$p^2 + 6p + 2 = 0$	<b>f.</b>	$a^2 + 6a + 3 = 0$
<b>g.</b>	$b^2 - 5b + 2 = 0$	<b>h.</b>	$z^2 - 9z + 4 = 0$	<b>i.</b>	$q^2 - 7q + 5 = 0$
<b>j.</b>	$x^2 - 10x + 3 = 0$	<b>k.</b>	$c^2 - 8c + 8 = 0$	<b>l.</b>	$w^2 - 4w + 2 = 0$
<b>m.</b>	$k^2 + 12k - 20 = 0$	<b>n.</b>	$d^2 + 11d - 15 = 0$	<b>o.</b>	$s^2 + 8s - 17 = 0$
<b>p.</b>	$a^2 + 3a - 9 = 0$	<b>q.</b>	$y^2 + 2y - 11 = 0$	<b>r.</b>	$c^2 + 3c - 12 = 0$
<b>s.</b>	$8x^2 + 8x + 1 = 0$	<b>t.</b>	$5b^2 + 3b - 9 = 0$	<b>u.</b>	$2p^2 - 9p - 3 = 0$
<b>v.</b>	$7m^2 - 6m + 1 = 0$	<b>w.</b>	$3x^2 + 3x - 8 = 0$	<b>x.</b>	$4c^2 - 3c - 9 = 0$

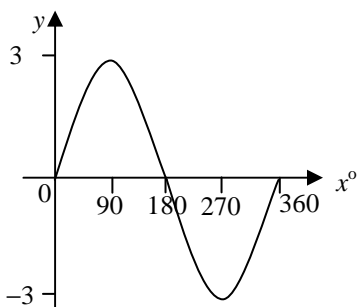
# Trigonometry ~ Graphs 1

**Q1.** The graphs represent the functions  $a \sin x^\circ$  and  $a \cos x^\circ$ . Write down the equation for each.

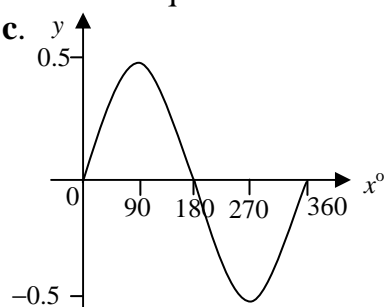
**a.**



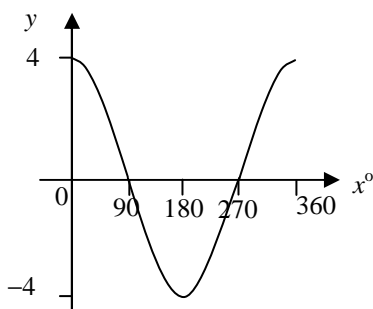
**b.**



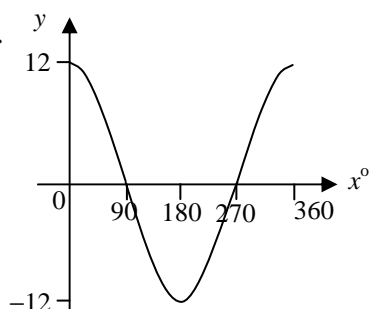
**c.**



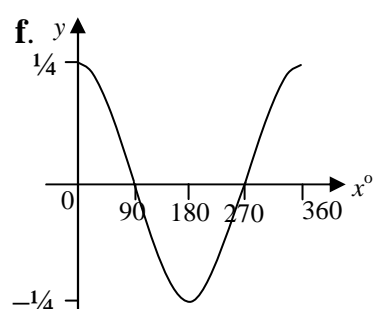
**d.**



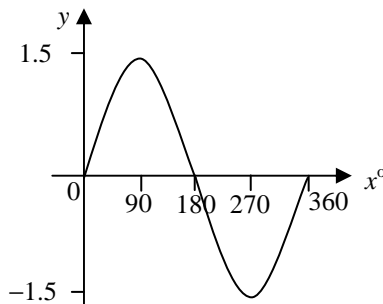
**e.**



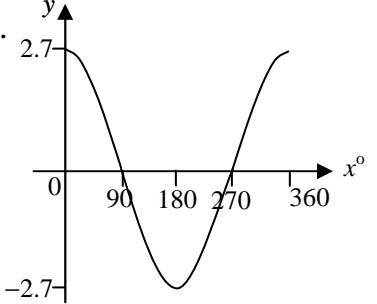
**f.**



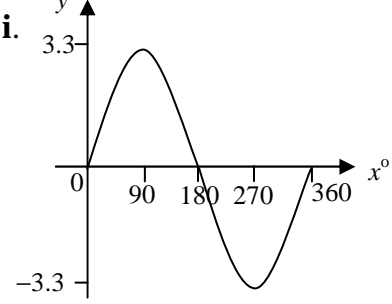
**g.**



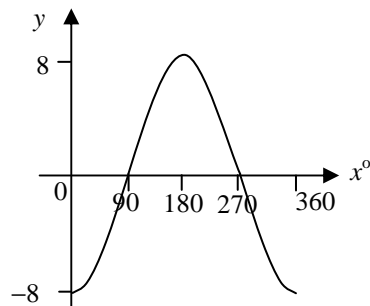
**h.**



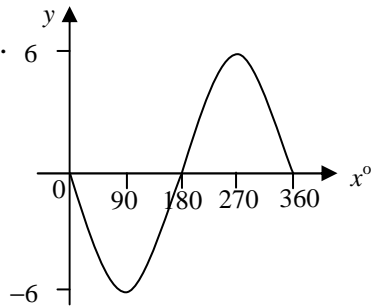
**i.**



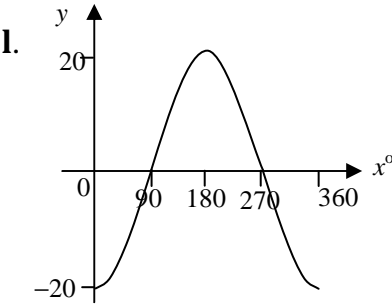
**j.**



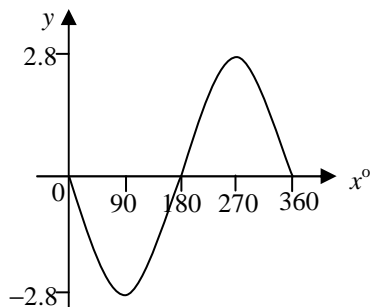
**k.**



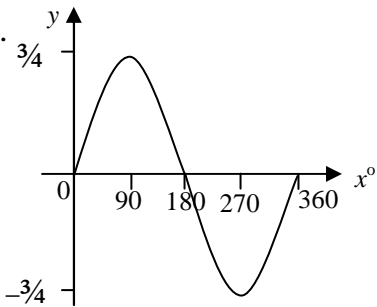
**l.**



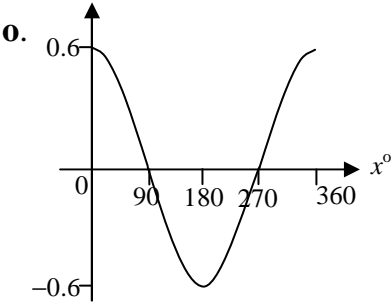
**m.**



**n.**



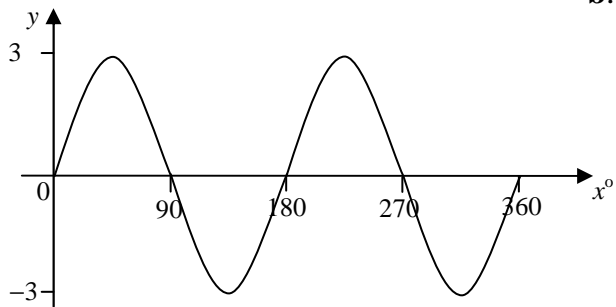
**o.**



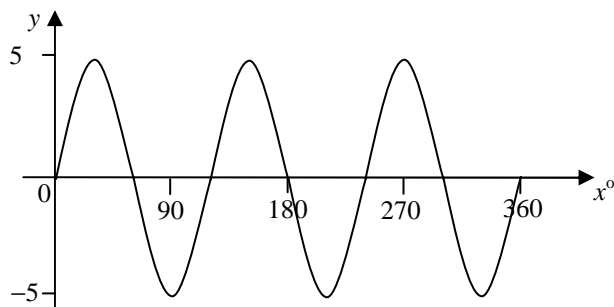
## Trigonometry ~ Graphs 2

**Q1.** The graphs represent trigonometric functions. Write down the equation for each.

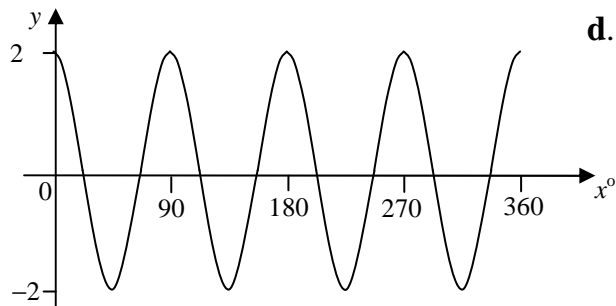
**a.**



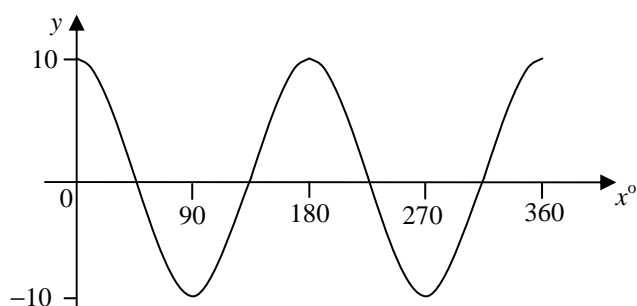
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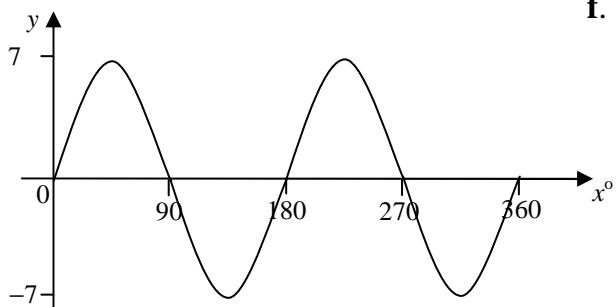
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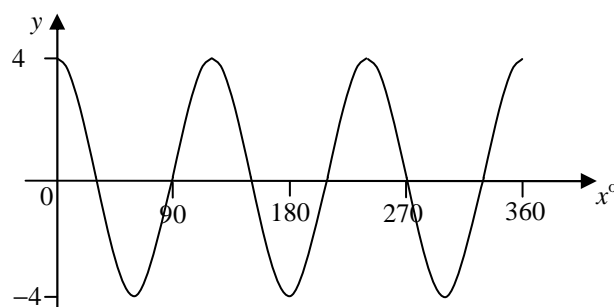
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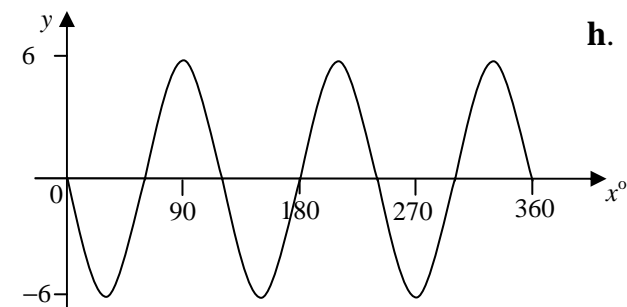
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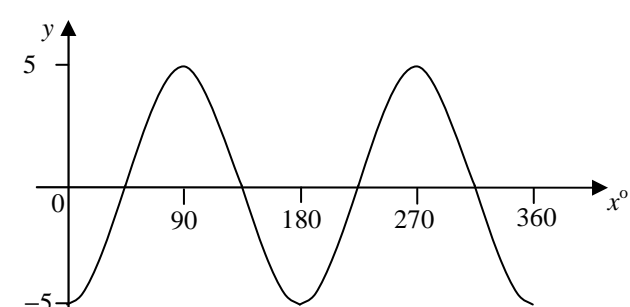
**f.**



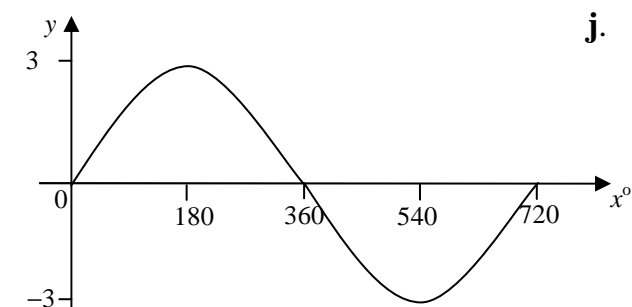
**g.**



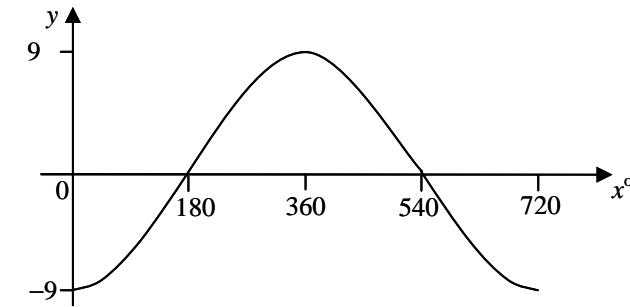
**h.**

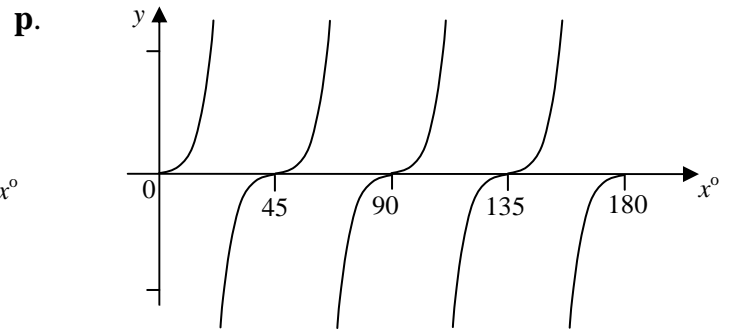
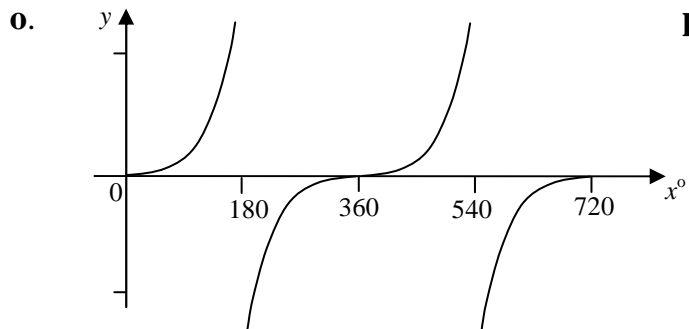
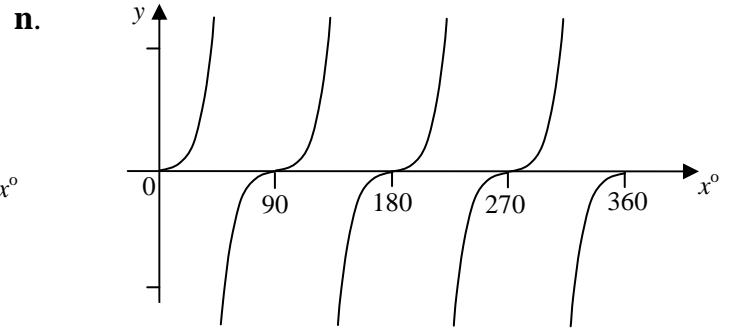
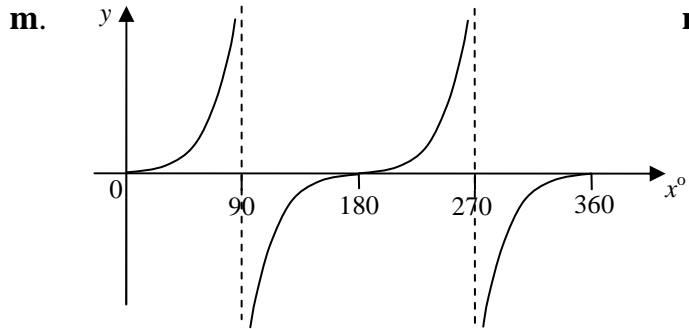
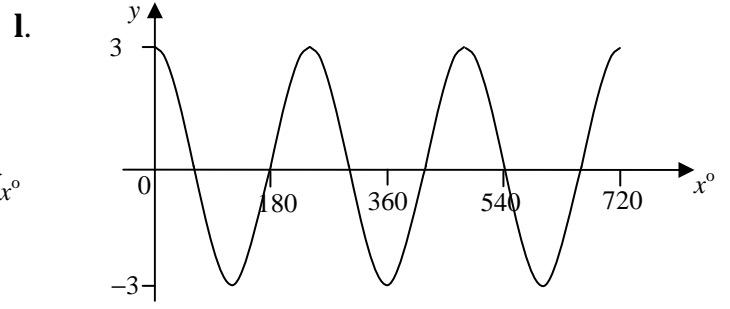
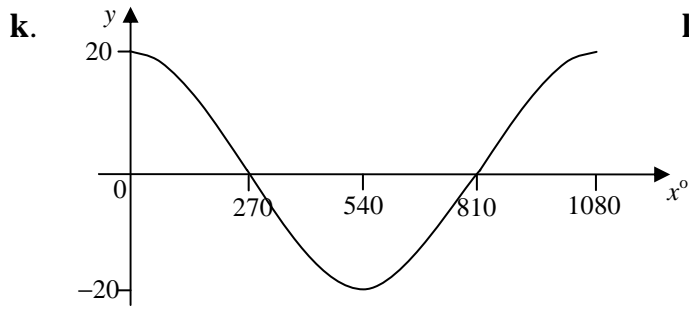


**i.**



**j.**





**Q2.** Make sketches of the following functions,  $0 \leq x < 360$ , clearly marking any important points.

**a.**  $y = \cos x^\circ$

**b.**  $y = \sin x^\circ$

**c.**  $y = \tan x^\circ$

**d.**  $y = 3 \sin x^\circ$

**e.**  $y = 2 \cos x^\circ$

**f.**  $y = \sin 2x^\circ$

**g.**  $y = \cos 3x^\circ$

**h.**  $y = 2 \sin 3x^\circ$

**i.**  $y = 3 \cos 2x^\circ$

**j.**  $y = 4 \cos 3x^\circ$

**k.**  $y = 3 \sin \frac{1}{2}x^\circ$

**l.**  $y = 5 \cos \frac{3}{2}x^\circ$

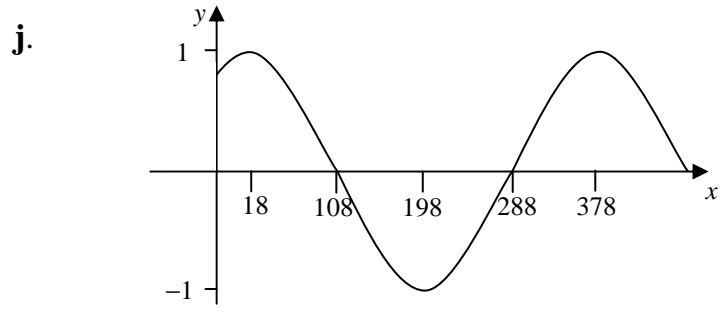
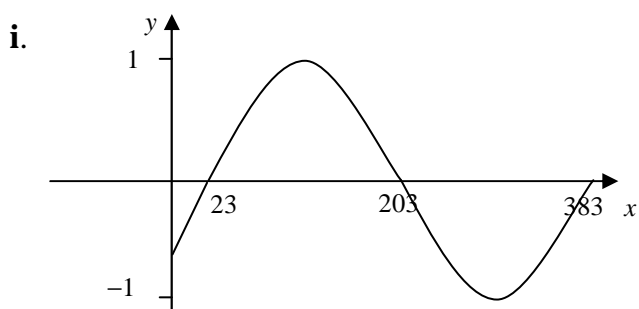
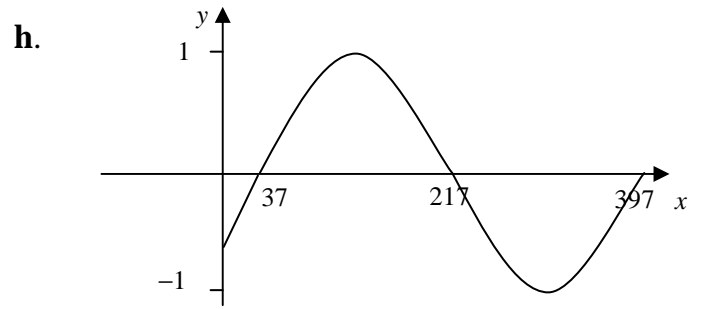
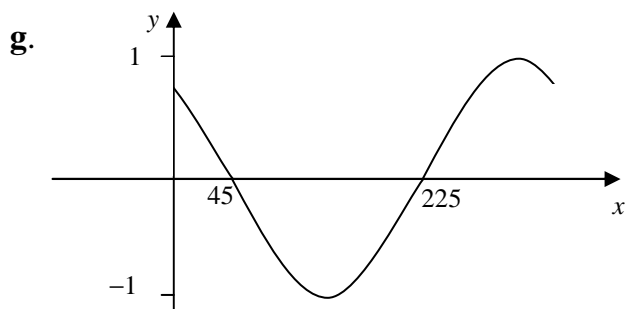
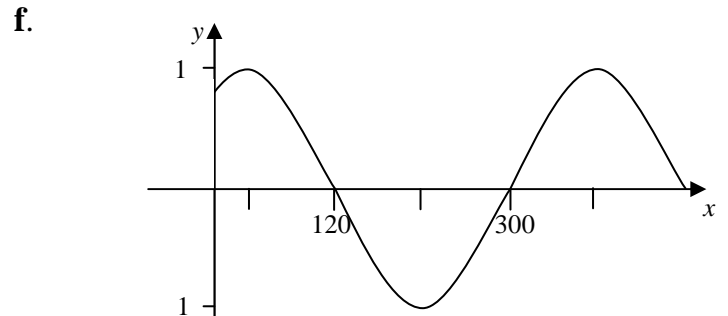
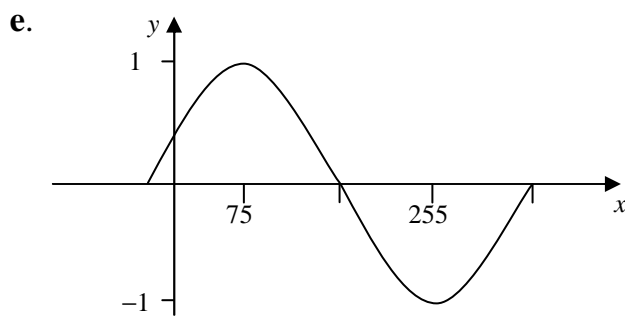
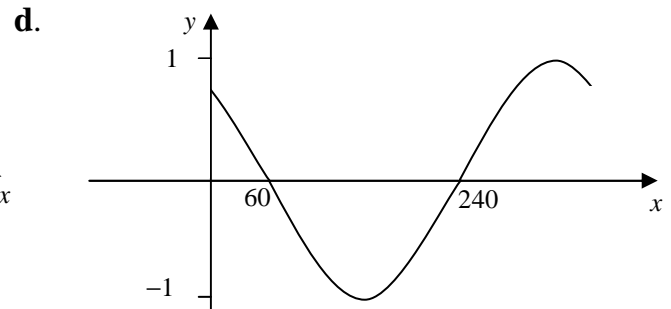
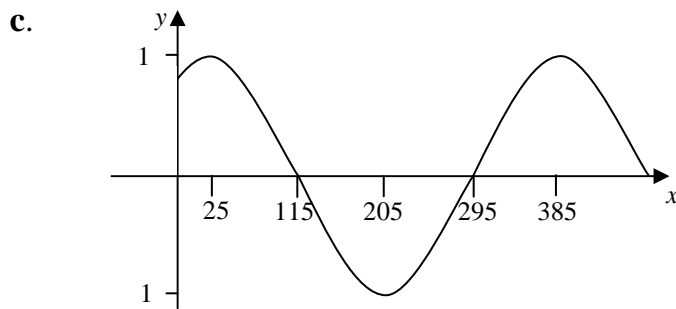
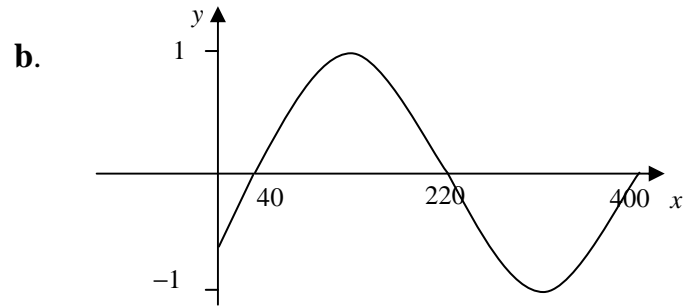
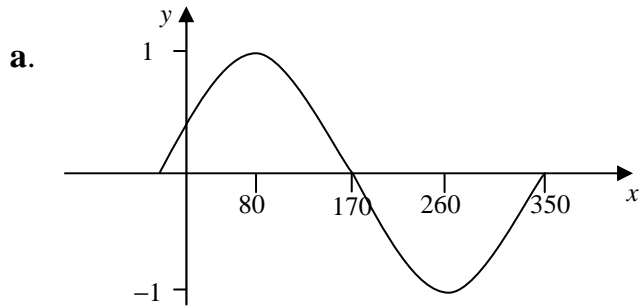
**m.**  $y = \tan 2x^\circ$

**n.**  $y = -2 \sin 3x^\circ$

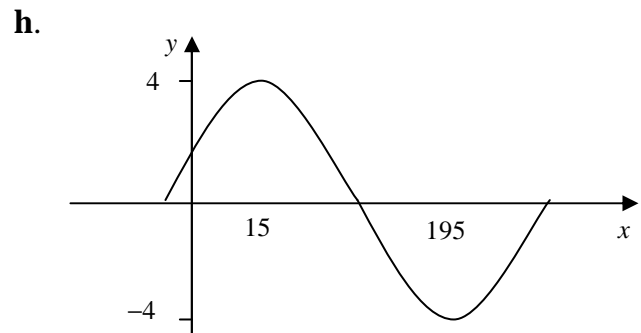
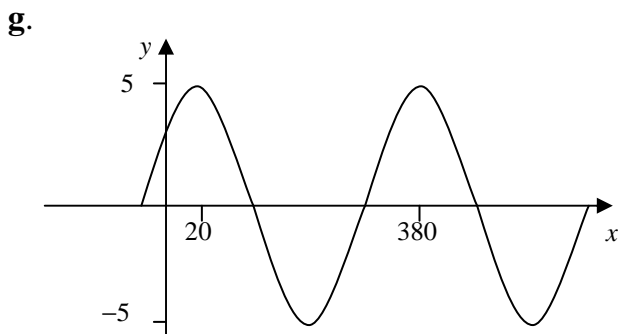
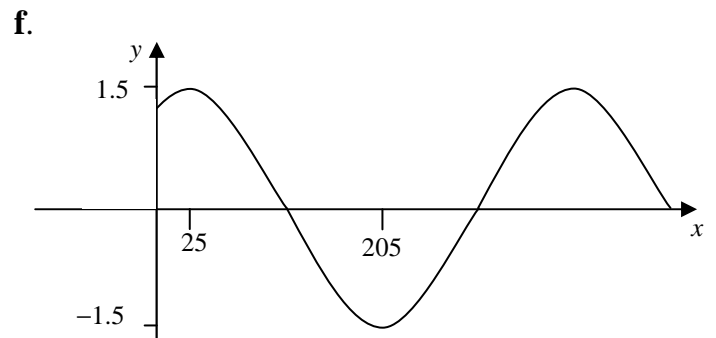
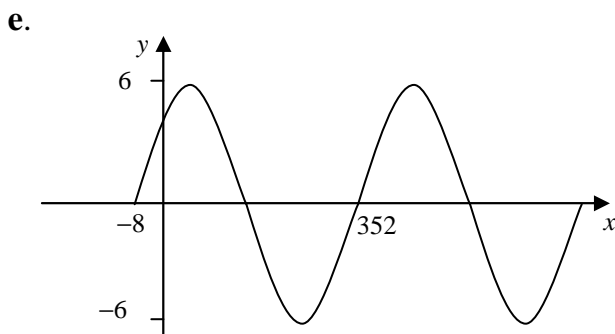
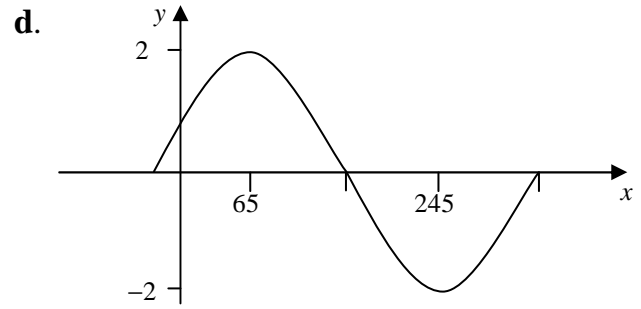
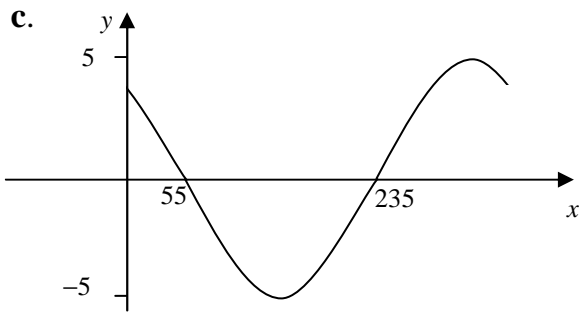
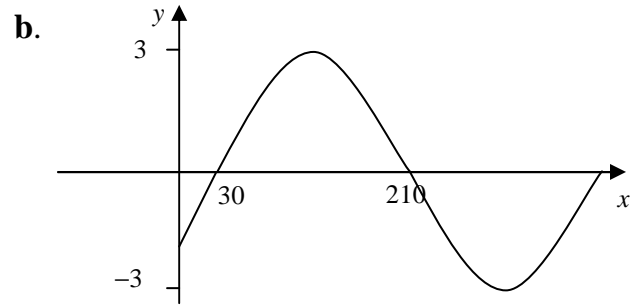
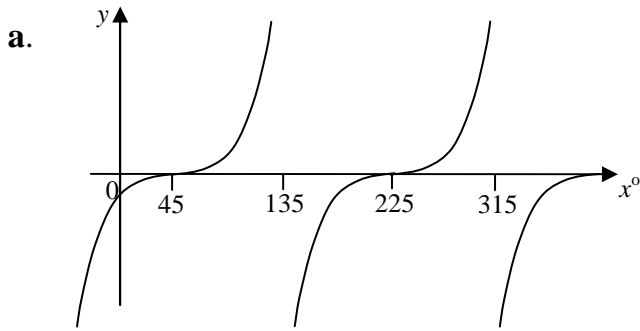
**o.**  $y = -8 \cos 4x^\circ$

## Trigonometry ~ Graphs 3

**Q1.** The graphs represent the functions  $\sin(x \pm a)^\circ$  and  $\cos(x \pm a)^\circ$ . Write down the equation for each.



**Q2.** Write down the equation for each graph shown below.



**Q3.** Make a neat sketch of these trig. functions showing the important values,  $0 \leq x \leq 360$ .

**a.**  $y = \sin(x - 50)^\circ$

**b.**  $y = \sin(x + 30)^\circ$

**c.**  $y = \cos(x - 20)^\circ$

**d.**  $y = \cos(x + 60)^\circ$

**e.**  $y = \tan(x - 30)^\circ$

**f.**  $y = \sin(x - 45)^\circ$

**g.**  $y = \cos(x + 90)^\circ$

**h.**  $y = \sin(x - 90)^\circ$

**i.**  $y = \tan(x + 45)^\circ$

**j.**  $y = \cos(x - 10)^\circ$

**l.**  $y = \cos(x - 33)^\circ$

**m.**  $y = \sin(x + 18)^\circ$



## Trigonometry ~ Equations

**Q1.** Solve the following equations where  $0 \leq x \leq 360$

- |                                   |                                   |                                   |
|-----------------------------------|-----------------------------------|-----------------------------------|
| <b>a.</b> $\sin x^\circ = 0.5$    | <b>b.</b> $\cos x^\circ = 0.866$  | <b>c.</b> $\tan x^\circ = 1$      |
| <b>d.</b> $\cos x^\circ = -0.5$   | <b>e.</b> $\tan x^\circ = -0.577$ | <b>f.</b> $\sin x^\circ = -0.866$ |
| <b>g.</b> $\tan x^\circ = 1.732$  | <b>h.</b> $\sin x^\circ = 0.707$  | <b>i.</b> $\cos x^\circ = 0.375$  |
| <b>j.</b> $\sin x^\circ = -0.707$ | <b>k.</b> $\cos x^\circ = -0.866$ | <b>l.</b> $\tan x^\circ = -1.732$ |

**Q2.** Solve the following equations where  $0 \leq x \leq 360$

- |                                   |                                   |                                   |
|-----------------------------------|-----------------------------------|-----------------------------------|
| <b>a.</b> $\sin x^\circ = 0.313$  | <b>b.</b> $\cos x^\circ = 0.425$  | <b>c.</b> $\tan x^\circ = 5.145$  |
| <b>d.</b> $\cos x^\circ = -0.087$ | <b>e.</b> $\tan x^\circ = -0.869$ | <b>f.</b> $\sin x^\circ = -0.191$ |
| <b>g.</b> $\tan x^\circ = 11.43$  | <b>h.</b> $\sin x^\circ = 0.695$  | <b>i.</b> $\cos x^\circ = 0.755$  |
| <b>j.</b> $\sin x^\circ = -0.358$ | <b>k.</b> $\cos x^\circ = -0.682$ | <b>l.</b> $\tan x^\circ = -0.268$ |

**Q3.** Solve the following equations where  $0 \leq x \leq 360$

- |                                   |                                  |                                  |
|-----------------------------------|----------------------------------|----------------------------------|
| <b>a.</b> $2 \sin x^\circ = 1$    | <b>b.</b> $3 \cos x^\circ = 2$   | <b>c.</b> $3 \tan x^\circ = 5$   |
| <b>d.</b> $2 \cos x^\circ = -1$   | <b>e.</b> $2 \tan x^\circ = -8$  | <b>f.</b> $4 \sin x^\circ = -3$  |
| <b>g.</b> $5 \tan x^\circ = 23.5$ | <b>h.</b> $5 \sin x^\circ = 2$   | <b>i.</b> $6 \cos x^\circ = 1$   |
| <b>j.</b> $8 \sin x^\circ = -3$   | <b>k.</b> $11 \cos x^\circ = -9$ | <b>l.</b> $10 \tan x^\circ = -9$ |

**Q4.** Solve the following equations where  $0 \leq x \leq 360$

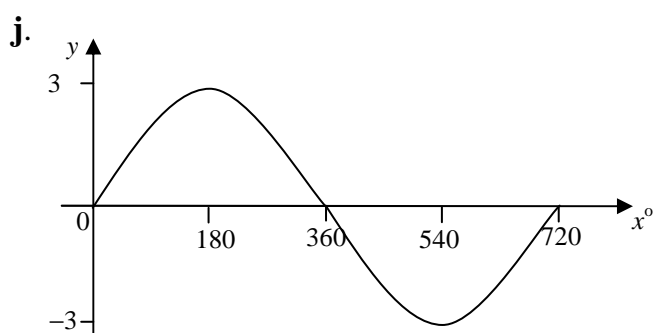
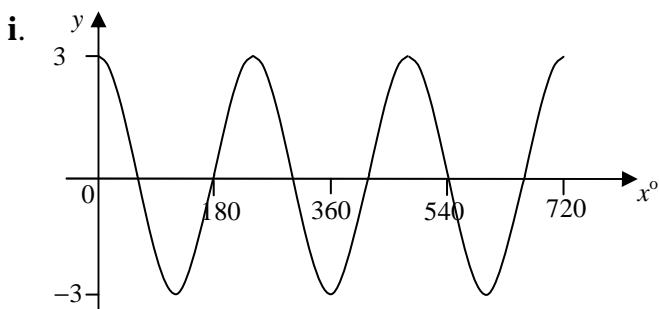
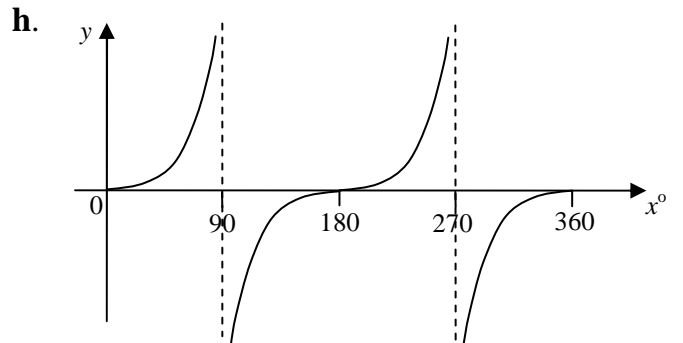
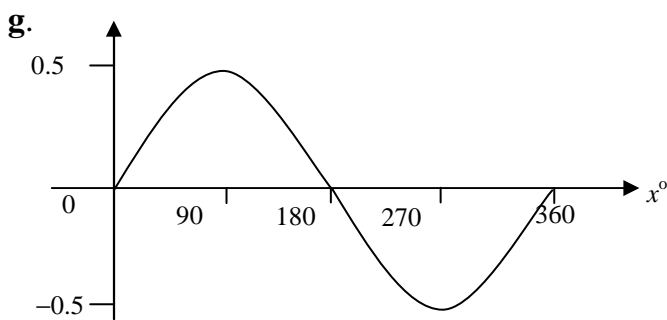
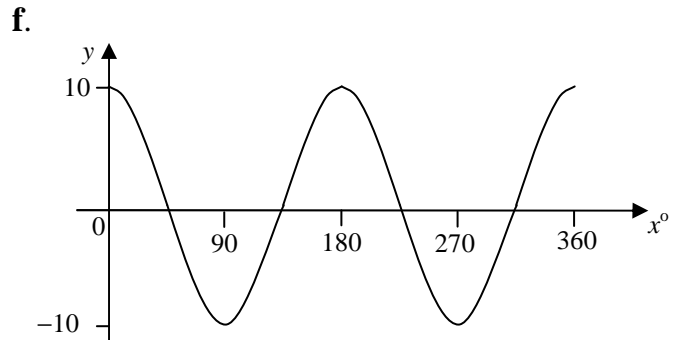
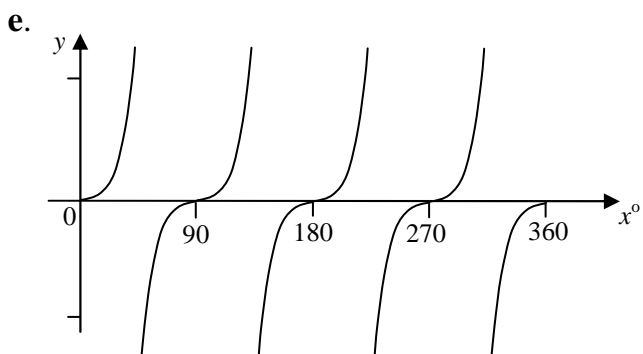
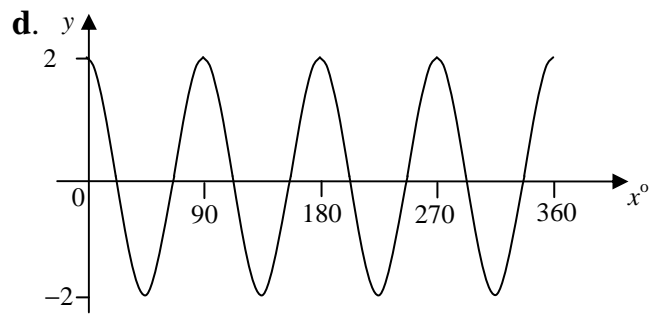
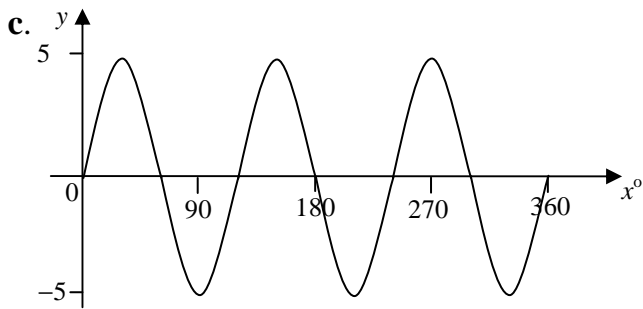
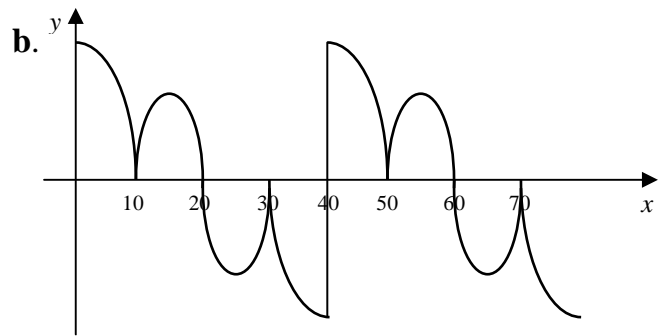
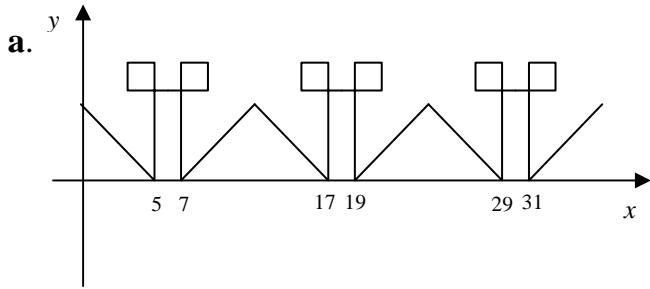
- |                                    |                                    |                                    |
|------------------------------------|------------------------------------|------------------------------------|
| <b>a.</b> $\sin x^\circ - 1 = 0$   | <b>b.</b> $\cos x^\circ + 1 = 0$   | <b>c.</b> $\tan x^\circ - 1 = 0$   |
| <b>d.</b> $2 \sin x^\circ + 1 = 0$ | <b>e.</b> $2 \cos x^\circ - 1 = 0$ | <b>f.</b> $2 \tan x^\circ - 1 = 0$ |
| <b>g.</b> $4 \cos x^\circ - 3 = 0$ | <b>h.</b> $3 \sin x^\circ - 2 = 0$ | <b>i.</b> $5 \cos x^\circ + 2 = 0$ |
| <b>j.</b> $3 \tan x^\circ - 2 = 0$ | <b>k.</b> $3 \cos x^\circ + 1 = 0$ | <b>l.</b> $7 \sin x^\circ + 3 = 0$ |

**Q5.** Solve the following equations where  $0 \leq x \leq 360$

- |   |                                      |   |
|---|--------------------------------------|---|
| <b>a.</b> $4 \cos x^\circ + 3 = 2$        | <b>b.</b> $10 \sin x^\circ - 4 = 3$  | <b>c.</b> $2 \tan x^\circ - 3 = 17$               |
| <b>d.</b> $7 + 10 \cos x^\circ = 12$      | <b>e.</b> $2 \tan x^\circ + 3 = 5$   | <b>f.</b> $17 - 5 \cos x^\circ = 20$              |
| <b>g.</b> $5 \sin x^\circ + 3 = 5$        | <b>h.</b> $21 + 2 \cos x^\circ = 20$ | <b>i.</b> $2 \sin x^\circ - 1.6 = 0$              |
| <b>j.</b> $3 \cos x^\circ + \sqrt{2} = 0$ | <b>k.</b> $7 \sin x^\circ - 1 = 4$   | <b>l.</b> $2 \sin x^\circ + \sqrt{3} = 2\sqrt{2}$ |

# Trigonometry ~ Periodicity & Identities

**Q1.** Write down the period of the following graphs



**Q2.** Write down the period of each of the following trigonometrical functions.

- |                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| <b>a.</b> $y = \sin 2x^\circ$   | <b>b.</b> $y = \tan 2x^\circ$   | <b>c.</b> $y = \cos 2x^\circ$   |
| <b>d.</b> $y = \tan 3x^\circ$   | <b>e.</b> $y = \cos 4x^\circ$   | <b>f.</b> $y = \sin 3x^\circ$   |
| <b>g.</b> $y = \cos 1.5x^\circ$ | <b>h.</b> $y = \sin 4.5x^\circ$ | <b>i.</b> $y = \tan 0.5x^\circ$ |
| <b>j.</b> $y = \sin 8x^\circ$   | <b>k.</b> $y = \tan 6x^\circ$   | <b>l.</b> $y = \cos 12x^\circ$  |
| <b>m.</b> $y = \tan 18x^\circ$  | <b>n.</b> $y = \cos 9x^\circ$   | <b>o.</b> $y = \sin 30x^\circ$  |
| <b>p.</b> $y = \cos 15x^\circ$  | <b>q.</b> $y = \sin 10x^\circ$  | <b>r.</b> $y = \tan 4x^\circ$   |

**Q3.** Write down the period of each of the following trigonometrical functions.

- |   |   |   |
|---|---|---|
| <b>a.</b> $y = \sin \frac{1}{2}x^\circ$ | <b>b.</b> $y = \tan \frac{1}{3}x^\circ$ | <b>c.</b> $y = \cos \frac{1}{4}x^\circ$ |
| <b>d.</b> $y = \tan \frac{1}{5}x^\circ$ | <b>e.</b> $y = \cos \frac{1}{6}x^\circ$ | <b>f.</b> $y = \sin \frac{2}{3}x^\circ$ |
| <b>g.</b> $y = 3\cos 2x^\circ$          | <b>h.</b> $y = 4\sin 3x^\circ$          | <b>i.</b> $y = 2\tan 2x^\circ$          |
| <b>j.</b> $y = 5\sin 2x^\circ$          | <b>k.</b> $y = 4\tan x^\circ$           | <b>l.</b> $y = 2\cos 4x^\circ$          |

**Q4.** Simplify

- |   |   |   |
|---|---|---|
| <b>a.</b> $3 \cos^2x + 3 \sin^2x$                 | <b>b.</b> $1 - \cos^2x$                           | <b>c.</b> $\cos A \tan A$                         |
| <b>d.</b> $5 - 5 \sin^2B^\circ$                   | <b>e.</b> $\frac{4 \sin a^\circ}{4 \cos a^\circ}$ | <b>f.</b> $\frac{4 \tan x^\circ}{2 \sin x^\circ}$ |
| <b>g.</b> $\frac{(1 - \sin^2 x)}{2 \cos x}$       | <b>h.</b> $\frac{8 - 8 \cos^2 x}{2 \sin x}$       | <b>i.</b> $\frac{3 \sin x \cos x}{6 \tan x}$      |
| <b>j.</b> $4\sin^2A + 3 \cos^2A - 3$              | <b>k.</b> $4 \cos^2B - 2 \sin^2B + 2$             |   |
| <b>l.</b> $(\cos x + \sin x)^2 - 2 \sin x \cos x$ | <b>m.</b> $\tan^2a(1 - \sin^2a)$                  |   |

**Q5.** Prove that

- a.**  $2 \cos^2A + 3 \sin^2A = 3 - \cos^2A$
- b.**  $\frac{1}{\tan x} + \tan x = \frac{1}{\sin x \cos x}$
- c.**  $(2 \cos B + 3 \sin B)^2 + (3 \cos B - 2 \sin B)^2 = 13$
- d.**  $(1 + \sin x)(1 - \sin x) = \cos^2x$
- e.**  $\sin \theta \cdot \tan \theta = \frac{1 - \cos^2 \theta}{\cos \theta}$

## ANSWERS

### Algebraic Operations 1 ~ Fractions 1

Q1.	a. $\frac{1}{2}$	b. $\frac{2}{3}$	c. $\frac{15}{8}$	d. $\frac{3}{4}$	e. $2a$	f. $\frac{3b}{2}$
	g. $\frac{3}{2x}$	h. $\frac{5}{3y}$	i. $\frac{1}{4c}$	j. $\frac{4}{a}$	k. $\frac{1}{4p}$	l. $\frac{6a}{c}$
	m. $\frac{6p}{5q}$	n. $\frac{27x^2}{2}$	o. $\frac{3n}{4}$	p. $\frac{4df}{5e}$		
Q2.	a. $\frac{a+2b}{2}$	b. $2(x+3y)$	c. $\frac{3+a}{b}$	d. $\frac{x+y}{2}$		
	e. $\frac{y+x}{y+6}$	f. $\frac{a+2b}{3b}$	g. $\frac{b(5+3b)}{2}$	h. $\frac{7p+5q}{s}$		
	i. $\frac{3}{2b-c}$	j. $\frac{2}{3(x+y)}$	k. $\frac{t}{3r-t}$	l. $\frac{1}{2a+3b}$		
	m. $\frac{7p}{4}$	n. $\frac{4}{3a}$	o. $\frac{2n}{3}$	p. $\frac{3x}{2}$		
Q3.	a. $b-2$	b. $x+9$	c. $a-5$	d. $y-6$		
	e. $\frac{c+7}{2}$	f. $\frac{a+8}{2}$	g. $\frac{p+1}{5}$	h. $\frac{q-3}{3}$		
	i. $\frac{a-b}{3}$	j. $\frac{x+y}{5}$	k. $m-3$	l. $\frac{d+4}{4}$		
	m. $x+2$	n. $\frac{1}{p-1}$	o. $\frac{a}{x+5}$	p. $\frac{a-1}{a+1}$		
	q. $\frac{b-3}{b+3}$	r. $\frac{c-3}{c+5}$	s. $\frac{3x-1}{x-2}$	t. $\frac{y+2}{y-3}$		
	u. $\frac{p-5}{p+1}$	v. $\frac{c-4}{c-7}$	w. $\frac{2x+1}{x+3}$	x. $\frac{2a-5}{a+4}$	y. $\frac{5b+1}{5b-1}$	

### Algebraic Operations 1 ~ Fractions 2

Q1.	a. $\frac{4}{5}$	b. $\frac{1}{2}$	c. $\frac{7}{8}$	d. $\frac{5}{6}$	e. $\frac{7}{9}$	f. $\frac{7}{12}$
	g. $\frac{17}{20}$	h. $\frac{5}{12}$	i. $\frac{23}{24}$	j. $\frac{9}{10}$	k. $\frac{11}{12}$	l. $\frac{13}{14}$
	m. $\frac{23}{56}$	n. $\frac{23}{40}$	o. $\frac{41}{63}$			
Q2.	a. $\frac{1}{2}$	b. $\frac{1}{3}$	c. $\frac{1}{6}$	d. $\frac{1}{12}$	e. $\frac{1}{4}$	f. $\frac{7}{16}$
	g. $\frac{5}{12}$	h. $\frac{1}{10}$	i. $\frac{3}{10}$	j. $\frac{11}{16}$	k. $\frac{1}{4}$	l. $\frac{1}{4}$
	m. $\frac{9}{40}$	n. $\frac{7}{30}$	o. $\frac{22}{63}$			

Q3.	a.	$\frac{1}{7}$	b.	$\frac{1}{10}$	c.	$\frac{2}{7}$	d.	$\frac{1}{12}$	e.	$\frac{1}{20}$	f.	$\frac{4}{7}$
	g.	$\frac{2}{7}$	h.	$\frac{1}{14}$	i.	$\frac{3}{8}$	j.	$\frac{4}{39}$	k.	$\frac{3}{40}$	l.	$\frac{2}{3}$
	m.	$\frac{4}{15}$	n.	$\frac{3}{4}$	o.	$\frac{10}{27}$						
Q4.	a.	$\frac{3}{4}$	b.	$\frac{7}{5}$	c.	$\frac{16}{15}$	d.	$\frac{15}{14}$	e.	$\frac{1}{4}$	f.	$\frac{5}{3}$
	g.	$\frac{4}{9}$	h.	$\frac{6}{11}$	i.	$\frac{2}{3}$	j.	$\frac{1}{2}$	k.	$\frac{18}{25}$	l.	$\frac{8}{15}$
	m.	$\frac{16}{27}$	n.	$\frac{15}{28}$	o.	$\frac{16}{9}$						
Q5.	a.	$\frac{2a}{5}$	b.	$\frac{b}{2}$	c.	$\frac{7x}{8}$	d.	$\frac{5p}{6}$	e.	$\frac{7y}{9}$	f.	$\frac{5}{m}$
	g.	$\frac{6}{x}$	h.	$\frac{9}{2a}$	i.	$\frac{13}{3y}$	j.	$\frac{43}{5p}$	k.	$\frac{3b+2a}{ab}$	l.	$\frac{5y+3x}{xy}$
	m.	$\frac{2n+7m}{mn}$	n.	$\frac{4q+3p}{pq}$	o.	$\frac{9d+7c}{cd}$	p.	$\frac{9y+4x}{6xy}$				
	q.	$\frac{8b+15a}{6ab}$	r.	$\frac{2b+9a}{3ab}$	s.	$\frac{5n+6m}{4mn}$	t.	$\frac{14q+2p}{6pq}$				
	u.	$\frac{a+2}{a^2}$	v.	$\frac{5+3x}{x^2}$	w.	$\frac{3b+12}{3b^2}$	x.	$\frac{21+8p}{6p^2}$	y.	$\frac{24m+10}{6m^2}$		
Q6.	a.	$\frac{2a}{5}$	b.	$\frac{3b}{10}$	c.	$\frac{5x}{8}$	d.	$\frac{p}{6}$	e.	$\frac{2y}{9}$	f.	$\frac{3}{m}$
	g.	$\frac{4}{x}$	h.	$\frac{9}{2a}$	i.	$\frac{2}{3y}$	j.	$\frac{37}{5p}$	k.	$\frac{3b-2a}{ab}$	l.	$\frac{5y-3x}{xy}$
	m.	$\frac{7n-2m}{mn}$	n.	$\frac{4q-3p}{pq}$	o.	$\frac{9d-7c}{cd}$	p.	$\frac{9y-4x}{6xy}$				
	q.	$\frac{10a-9b}{6ab}$	r.	$\frac{5b-2a}{3ab}$	s.	$\frac{5n-6m}{4mn}$	t.	$\frac{14q-2p}{6pq}$				
	u.	$\frac{a-2}{a^2}$	v.	$\frac{7-3x}{x^2}$	w.	$\frac{4b-9}{3b^2}$	x.	$\frac{21-8p}{6p^2}$	y.	$\frac{24m-10}{6m^2}$		
Q7.	a.	$\frac{x^2}{18}$	b.	$\frac{y^2}{8}$	c.	$\frac{ab}{14}$	d.	$\frac{pq}{24}$	e.	$\frac{c^2}{30}$	f.	$\frac{12}{a^2}$
	g.	$\frac{30}{xy}$	h.	$\frac{12}{p^2}$	i.	$\frac{8}{15m^2}$	j.	$\frac{4}{3bc}$	k.	$\frac{5}{4}$	l.	$\frac{20}{21}$
	m.	$\frac{8}{15y}$	n.	$\frac{2}{7a^3}$	o.	$\frac{10}{3p^4}$	p.	$\frac{s}{3t}$	q.	$\frac{15}{8q}$	r.	$\frac{7b^2c^2}{9a}$
	s.	$\frac{8m^3}{5n^2}$	t.	$\frac{2z^2}{3y^2}$	u.	$\frac{5a^2b^2}{2c^3}$	v.	$\frac{3a}{14d}$	w.	$8x^2y$		
	x.	$\frac{3}{2s^2t^2}$	y.	$\frac{8aq^2}{5p^2}$	z.	$\frac{2(x+1)}{3x^2}$						
Q8.	a.	$\frac{1}{2}$	b.	$\frac{x}{y}$	c.	$\frac{2b}{5}$	d.	$\frac{p}{2}$	e.	$\frac{4}{c}$	f.	$\frac{1}{2}$

g.	$\frac{m}{2k}$	h.	$\frac{y}{3}$	i.	$\frac{2}{b}$	j.	$\frac{x}{8}$	k.	$\frac{18}{25}$	l.	$\frac{8pq}{15}$
m.	$\frac{16a^2}{27}$	n.	$\frac{15}{28n^3}$	o.	$\frac{16a^2y}{9}$	p.	$\frac{5sv^2}{3}$	q.	$\frac{4am^3}{9n}$	r.	$\frac{6c^2}{11q^2}$
s.	$\frac{2d^3}{3x^2y^4}$	t.	$\frac{6d^2}{7f^2}$								

## Algebraic Operations 2 ~ Formulae

**Q1.**

a.	$x = y - 3$	b.	$x = y + 5$	c.	$x = y - a$	d.	$x = y + b$
e.	$x = \frac{y}{3}$	f.	$x = \frac{y}{10}$	g.	$x = \frac{y}{k}$	h.	$x = \frac{y}{a}$
i.	$x = y - 3p$	j.	$x = y + 5t$	k.	$x = \frac{y-1}{2}$	l.	$x = \frac{y+7}{3}$
m.	$x = \frac{y-4a}{7}$	n.	$x = \frac{y-3b}{4}$	o.	$x = \frac{y-8}{10}$		

**Q2.**

a.	$a = 4 - b$	b.	$a = 12 - d$	c.	$a = 5x - y$	d.	$a = \frac{2-m}{2}$
e.	$a = \frac{7-q}{5}$	f.	$a = \frac{20-c}{3}$	g.	$a = \frac{s-r}{2}$	h.	$a = \frac{d-t}{4}$
i.	$a = \frac{4b-z}{5}$	j.	$a = \frac{2h-k}{7}$	k.	$a = \frac{6q-p}{11}$	l.	$a = \frac{2x-g}{9}$

**Q3.**

a.	$x = \frac{y-b}{a}$	b.	$x = \frac{y-c}{m}$	c.	$x = \frac{t+r}{s}$	d.	$x = \frac{p-2r}{q}$
e.	$x = \frac{m+3n}{f}$	f.	$x = \frac{a-b}{c}$	g.	$x = \frac{h-k}{m}$	h.	$x = \frac{d-3b}{c}$
i.	$x = \frac{kc-g}{h}$						

**Q4.**

a.	$l = \frac{P}{4}$	b.	$I = \frac{V}{R}$	c.	$T = \frac{S}{D}$	d.	$b = \frac{A}{l}$	e.	$d = \frac{C}{\pi}$	f.	$U = \frac{G}{T}$
g.	$t = \frac{v-u}{a}$	h.	$l = \frac{P-2b}{2}$	i.	$y = \frac{H-5m}{x}$						

**Q5.**

a.	$c = 2b$	b.	$c = 5x$	c.	$c = 4y$	d.	$c = 6m$
e.	$c = 9k$	f.	$c = 10d$	g.	$c = 2(a-2)$	h.	$c = 3(h+5)$
i.	$c = 4(p-q)$	j.	$c = 10(y+x)$	k.	$c = 8(t-2s)$	l.	$c = 5(r+3q)$

**Q6.**

a.	$x = \frac{3}{y}$	b.	$x = \frac{c}{d}$	c.	$x = \frac{y}{m}$	d.	$x = \frac{a+2}{s}$
e.	$x = \frac{z-1}{w}$	f.	$x = \frac{b+c}{a}$	g.	$x = 9a - 8$	h.	$x = 2k + 5$
i.	$x = 3 - 4p$	j.	$x = \frac{2}{y-1}$	k.	$x = \frac{6}{z+7}$	l.	$x = \frac{m}{h-k}$

**Q7.**

a.	$k = y^2$	b.	$k = x^2$	c.	$k = m^2$	d.	$k = a^2b$
e.	$k = c^2d$	f.	$k = h^2g$	g.	$k = \frac{t}{s^2}$	h.	$k = \frac{p}{q^2}$
i.	$k = \frac{z}{w^2}$	j.	$k = \sqrt{r}$	k.	$k = \sqrt{ab}$	l.	$k = \sqrt{\frac{p}{q}}$

	m.	$k = \sqrt{y-x}$	n.	$k = \sqrt{c+d}$	o.	$k = \sqrt{\frac{x+1}{3}}$
Q8.	a.	$s = \frac{v^2 - u^2}{2a}$	b.	$u = \sqrt{v^2 - 2as}$	c.	$h = \frac{V}{\pi r^2}$
	d.	$r = \sqrt{\frac{V}{\pi h}}$	e.	$A = \pi r^2$	f.	$a = \frac{(L-3)^2}{6}$
	g.	$p = 4k^2 - 4$	h.	$y = \frac{x^2 t}{4z}$	i.	$b = \frac{x}{(2ar)^2}$
	j.	$A = \sqrt{\frac{st}{(x-3y)}}$	k.	$x = \frac{R+3A^2 y}{A^2}$	l.	$n = \sqrt{1-(na)^2}$
	m.	$n = \frac{t}{t-d}$	n.	$R = \frac{r_1 r_2}{r_1 + r_2}$	o.	$a = \sqrt{\frac{4d}{x+b}}$

### Algebraic Operations 3 ~ Surds

Q1.	a.	$2\sqrt{5}$	b.	$2\sqrt{3}$	c.	$2\sqrt{2}$	d.	$3\sqrt{10}$	e.	$3\sqrt{2}$	f.	$2\sqrt{7}$
	g.	$3\sqrt{5}$	h.	$2\sqrt{6}$	i.	$4\sqrt{5}$	j.	$6\sqrt{2}$	k.	$10\sqrt{3}$	l.	$4\sqrt{2}$
	m.	$4\sqrt{10}$	n.	$3\sqrt{3}$	o.	$5\sqrt{6}$	p.	$2\sqrt{11}$	q.	$3\sqrt{7}$	r.	$5\sqrt{2}$
	s.	$5\sqrt{7}$	t.	$2\sqrt{15}$	u.	$20\sqrt{3}$	v.	$4\sqrt{14}$	w.	$40\sqrt{3}$	x.	$12\sqrt{3}$
Q2.	a.	$9\sqrt{3}$	b.	$6\sqrt{6}$	c.	$3\sqrt{2}$	d.	$-6\sqrt{7}$				
	e.	$0$	f.	$3\sqrt{5}$	g.	$-2\sqrt{3}$	h.	$11\sqrt{11}$				
Q3.	a.	$5\sqrt{3}$	b.	$2\sqrt{2}$	c.	$\sqrt{2}$	d.	$8\sqrt{2}$				
	e.	$6\sqrt{5}$	f.	$5\sqrt{6}$	g.	$3\sqrt{5}$	h.	$7\sqrt{10}$				
Q4.	a.	$2$	b.	$3$	c.	$11$	d.	$a$	e.	$5$	f.	$c$
	g.	$6$	h.	$k$	i.	$4$	j.	$6$	k.	$10$	l.	$8$
	m.	$\sqrt{ab}$	n.	$\sqrt{10x}$	o.	$\sqrt{pq}$	p.	$\sqrt{6k}$	q.	$2\sqrt{5}$	r.	$6\sqrt{2}$
	s.	$5\sqrt{2}$	t.	$6\sqrt{2}$	u.	$3\sqrt{2}$	v.	$2\sqrt{15}$	w.	$4\sqrt{2}$	x.	$5\sqrt{6}$
Q5.	a.	$2$	b.	$1\frac{1}{2}$	c.	$\frac{1}{4}$	d.	$\frac{1}{3}$	e.	$2$	f.	$\frac{1}{2}$
	g.	$1\frac{1}{2}$	h.	$1\frac{2}{3}$	i.	$\frac{1}{2}$	j.	$\frac{1}{3}$	k.	$6$	l.	$3\frac{1}{3}$
	m.	$2\sqrt{2}$	n.	$\frac{1}{2\sqrt{2}}$	o.	$\sqrt{14}$	p.	$\frac{1}{\sqrt{5}}$	q.	$\frac{2}{3}$	r.	$\frac{\sqrt{3}}{\sqrt{7}}$
Q6.	a.	$\sqrt{6} + \sqrt{3}$	b.	$6$	c.	$\sqrt{6} + 3\sqrt{2}$	d.	$3\sqrt{5} - 5$				
	e.	$-2$	f.	$8 + 2\sqrt{7}$	g.	$8 + 4\sqrt{3}$	h.	$-1$	i.	$27 + 6\sqrt{2}$		
Q7.	a.	$\frac{\sqrt{3}}{3}$	b.	$\sqrt{2}$	c.	$\frac{\sqrt{5}}{5}$	d.	$4\sqrt{3}$	e.	$\frac{\sqrt{6}}{2}$	f.	$\frac{4\sqrt{5}}{5}$
	g.	$5\sqrt{2}$	h.	$5\sqrt{7}$	i.	$\frac{4\sqrt{2}}{3}$	j.	$\frac{4\sqrt{5}}{7}$	k.	$\frac{5\sqrt{10}}{3}$	l.	$\frac{\sqrt{2}}{2}$
	m.	$2\sqrt{3}$	n.	$\frac{\sqrt{2}}{2}$	o.	$\frac{3\sqrt{5}}{10}$	p.	$\sqrt{2}$				
Q8.	a.	$\frac{\sqrt{6}}{2}$	b.	$\frac{\sqrt{10}}{5}$	c.	$2$	d.	$\sqrt{6}$	e.	$\frac{1}{2}$	f.	$\frac{\sqrt{6}}{6}$
	g.	$\sqrt{3}$	h.	$\frac{2\sqrt{3}}{3}$	i.	$\frac{\sqrt{3}}{3}$	j.	$\sqrt{5}$	k.	$\frac{1}{2}$	l.	$\frac{\sqrt{10}}{2}$
Q9.	a.	$-(1 + \sqrt{2})$	b.	$\frac{1 - \sqrt{3}}{-2}$	c.	$\frac{3(\sqrt{5} + 1)}{4}$	d.	$\frac{(\sqrt{2} + 2)}{3}$				

e.	$\frac{3(2-\sqrt{6})}{-2}$	f.	$\frac{5(3-\sqrt{2})}{7}$	g.	$-2(1+\sqrt{3})$	h.	$\frac{\sqrt{2}-2}{3}$
i.	$\frac{6(\sqrt{3}+\sqrt{2})}{1}$	j.	$\frac{3(\sqrt{10}-\sqrt{2})}{2}$	k.	$\frac{3(\sqrt{5}+\sqrt{6})}{11}$	l.	$\frac{14(9-\sqrt{2})}{79}$

### Algebraic Operations 4 ~ Indices

Q1.	a.	$3^6$	b.	$2^4$	c.	$10^7$	d.	$8^8$	e.	$7^7$	f.	$5^8$
	g.	$9^8$	h.	$6^{13}$	i.	$x^8$	j.	$c^{11}$	k.	$a^{14}$	l.	$y^{10}$
	m.	$b^{40}$	n.	$p^{10}$	o.	$d^6$	p.	$q^{20}$	q.	$t^{10}$	r.	$f^7$
	s.	$k^{13}$	t.	$z^{100}$	u.	$x^{80}$	v.	$y^{20}$	w.	$a^{90}$	x.	$b^1$
Q2.	a.	$2^5$	b.	$5^2$	c.	$12^3$	d.	$7^7$	e.	$20^4$	f.	$8^4$
	g.	$3^{15}$	h.	$4^2$	i.	$x^5$	j.	$a^4$	k.	$y^{10}$	l.	$b^3$
	m.	$p^1$	n.	$c^0$	o.	$q^6$	p.	$d^3$	q.	$x^6$	r.	$a^6$
	s.	$m^{13}$	t.	$s^0$	u.	$d^8$	v.	$y^{90}$	w.	$t^{99}$	x.	$w^{10}$
Q3.	a.	$3^8$	b.	$8^4$	c.	$10^6$	d.	$2^{10}$	e.	$4^{15}$	f.	$1^{14}$
	g.	$12^9$	h.	$5^{25}$	i.	$x^8$	j.	$y^{40}$	k.	$a^{21}$	l.	$m^{16}$
	m.	$b^{18}$	n.	$p^{15}$	o.	$k^{100}$	p.	$z^0$				
Q4.	a.	$4b^2$	b.	$343a^3$	c.	$81x^4$	d.	$32y^5$	e.	$a^4b^4$	f.	$x^7y^7$
	g.	$w^5z^5$	h.	$s^3t^3$	i.	$p^3q^6$	j.	$x^8y^2$	k.	$a^{10}b^{15}$	l.	$36a^{10}$
	m.	$1000x^6$	n.	$32c^{20}$	o.	$27a^3b^6$	p.	$16m^4k^2$				
Q5.	a.	$10a^8$	b.	$63x^9$	c.	$3p^3$	d.	$5b^6$	e.	$24y^7$	f.	$80q^{10}$
	g.	$8c^7$	h.	$8z^4$	i.	$k^5+k^7$	j.	$m^7-m^8$	k.	$2x^7+6x^6$		
	l.	$10a^7-15a^8$			m.	$x^3$	n.	$m^{14}$	o.	$10c^4$	p.	$6q^3$
	q.	$xy^{14}$	r.	$4a^{10}b^{28}$	s.	$4p^3$	t.	$\frac{8a^2b^{12}}{3}$				
Q6.	a.	1	b.	1	c.	1	d.	1	e.	1	f.	1
	g.	1	h.	1	i.	1	j.	1	k.	1	l.	1
Q7.	a.	$\frac{1}{3^2}$	b.	$\frac{1}{5^4}$	c.	$\frac{1}{2^6}$	d.	$\frac{1}{10^3}$	e.	$\frac{1}{4^5}$	f.	$\frac{1}{200^7}$
	g.	$\frac{1}{9^5}$	h.	$\frac{1}{x^2}$	i.	$\frac{1}{p^7}$	j.	$\frac{1}{y^{10}}$	k.	$\frac{2}{b^3}$	l.	$\frac{10}{q^x}$
	m.	$x^3$	n.	$w^5$	o.	$3a^2$	p.	$10c^8$	q.	$\frac{2t}{3}$	r.	$\frac{5y^3}{4}$
Q8.	a.	$3^{-2}$	b.	$6^{-9}$	c.	$5^{-4}$	d.	$2^{-7}$	e.	$10^{-3}$	f.	$4^{-4}$
	g.	$x^{-3}$	h.	$a^{-5}$	i.	$p^{-4}$	j.	$y^{-10}$	k.	$q^{-6}$	l.	$c^{-8}$
Q9.	a.	$m^{-2}$	b.	$x^5$	c.	$p^{-3}$	d.	$a^{-8}$	e.	$y^{-12}$	f.	$c^{-15}$
	g.	$q^{-15}$	h.	$w^8$	i.	$20b$	j.	27	k.	$2k^5$	l.	$\frac{3}{2}d^{-3}$
	m.	$x^5+x$	n.	$p-p^{-11}$	o.	$6a^6+9a^3$	p.	$2m^{-5}-5m^4$				
	q.	$v^{10}$	r.	$6h^{-1}$	s.	$6c^5$	t.	10				
Q10.	a.	2	b.	2	c.	6	d.	9	e.	4	f.	10
	g.	5	h.	27	i.	25	j.	8	k.	6	l.	$\frac{1}{2}$
	m.	$\frac{1}{2}$	n.	$\frac{1}{4}$	o.	$\frac{1}{3}$	p.	$\frac{1}{9}$	q.	$\frac{1}{64}$	r.	$\frac{1}{100}$
Q11.	a.	$x^3$	b.	$p^2$	c.	$a^6$	d.	$y^{-6}$	e.	$q^{-2}$	f.	$k^{-6}$
	g.	$g^2$	h.	$m^{-8}$	i.	$c^6$	j.	$h^{-5/2}$	k.	$z^{-3}$	l.	$b^{-12}$
	m.	1	n.	$y$	o.	$d^2$	p.	$s^3$	q.	$12x$	r.	1
	s.	$10x$	t.	$6x^{1/3}$	u.	1	v.	$2x$	w.	$4x^{1/3}$	x.	$\frac{2}{3}x^{-1/3}$
Q12.	a.	$\sqrt{x}$	b.	$\sqrt[3]{y}$	c.	$\sqrt[4]{a}$	d.	$\sqrt[3]{y^2}$	e.	$\sqrt[4]{b^3}$	f.	$\sqrt[3]{x^5}$



	g.	$\sqrt[5]{c^3}$	h.	$\sqrt[5]{a^4}$	i.	$\frac{1}{\sqrt[3]{c}}$	j.	$\frac{1}{\sqrt{z}}$	k.	$\frac{1}{\sqrt[3]{m^2}}$	l.	$\frac{1}{\sqrt[5]{k^3}}$
	m.	$\frac{1}{\sqrt[3]{p^4}}$	n.	$\frac{1}{\sqrt[3]{x^5}}$	o.	$\frac{1}{\sqrt[5]{w^4}}$	p.	$\frac{1}{\sqrt[7]{d^2}}$				
Q13.	a.	$x^{-1/2}$	b.	$a^{1/3}$	c.	$y^{3/2}$	d.	$z^{2/3}$	e.	$c^{2/3}$	f.	$x^{3/4}$
	g.	$p^{2/3}$	h.	$m^{2/3}$	i.	$a^{-1/2}$	j.	$z^{-1/2}$	k.	$x^{-2/3}$	l.	$a^{-2/3}$
	m.	$b^{-2/3}$	n.	$m^{-3/5}$	o.	$y^{-1/4}$	p.	$c^{-2/3}$				

### Quadratic Functions 1 ~ $y = ax^2$

Q1.	a.	$y=x^2$	b.	$y=3x^2$	c.	$y=5x^2$	d.	$y=3/2 x^2$
	e.	$y=5x^2$	f.	$y=3x^2$	g.	$y=-x^2$	h.	$y=-2x^2$
	i.	$y=-5x^2$	j.	$y=1/2 x^2$	k.	$y=1/4 x^2$	l.	$y=1/3 x^2$
	m.	$y=40x^2$	n.	$y=-25x^2$	o.	$y=-3/4 x^2$		

### Quadratic Functions 2 ~ $y = ax^2 + b$

Q1.	a.	$y=x^2 + 2$	b.	$y=x^2 - 1$	c.	$y=x^2 + 1.5$	d.	$y=-x^2 + 5$
	e.	$y=-x^2 + 3$	f.	$y=-x^2 - 2$	g.	$y=2x^2 + 1$	h.	$y=5x^2 + 4$
	i.	$y=3x^2 + 2$	j.	$y=2x^2 - 3$	k.	$y=5x^2 - 9$	l.	$y=-2x^2 + 2$
	m.	$y=-2x^2 + 12$	n.	$y=-3x^2 - 2$				

### Quadratic Functions 3 ~ $y = (x + a)^2 + b$

Q1.	a.	$y = (x - 2)^2 + 1$	b.	$y = (x - 1)^2 + 6$	c.	$y = (x - 4)^2$
	d.	$y = (x - 3)^2 - 4$	e.	$y = x^2 - 5$	f.	$y = (x + 1)^2 + 3$
	g.	$y = (x + 2)^2 - 4$	h.	$y = (x + 6)^2$	i.	$y = (x - 4)^2 + 20$
	j.	$y = (x - 10)^2 - 2$	k.	$y = (x - 25)^2 + 10$	l.	$y = (x + 30)^2 + 5$
	m.	$y = (x - 1)^2 - 1$	n.	$y = x^2 + 6$		

### Quadratic Functions 4 ~ Turning Points

Q1.	a.	(1, -2) min, $x = 1$	b.	(-2, 3) min, $x = -2$	c.	(3, -4) min, $x = 3$
	d.	(-2, -2) min, $x = -2$	e.	(1, 6) max, $x = 1$	f.	(-1, 4) max, $x = -1$
	g.	(3, -2) max, $x = 3$	h.	(-3, 3) max, $x = -3$		
Q2.	a.	(4, 1) min, $x = 4$	b.	(2, 5) min, $x = 2$	c.	(1, 7) min, $x = 1$
	d.	(2, -3) min, $x = 2$	e.	(3, -4) min, $x = 3$	f.	(5, -2) min, $x = 5$
	g.	(-4, 6) min, $x = -4$	h.	(-1, 5) min, $x = -1$	i.	(-8, 1) min, $x = -8$
	j.	(-3, 1) min, $x = -3$	k.	(-1/2, -3/4) min, $x = -1/2$		
	l.	(-0.5, -2.5) min, $x = -0.5$	m.	(1, 4) max, $x = 1$		
	n.	(-6, 3) max, $x = -6$	o.	(-7, -2) max, $x = -7$	p.	(2, 12) min, $x = 2$
	q.	(5, -1) min, $x = 5$	r.	(4, 3.75) min, $x = 4$		

### Quadratic Equations 1 ~ Graphs

Q1.	a.	0, 3	b.	-3, -2	c.	-2, 6	d.	-1, 8	e.	-10, 2	f.	-5, 1
Q2.	a.	0, 2	b.	1, 5	c.	-3, -1	d.	-4, 2				
Q3.	a.	0, 4	b.	0, -6	c.	0, 5	d.	3, 5	e.	-3, -3	f.	2, 2
	g.	-4, -2	h.	-6, -2	i.	2, 5	j.	1, 4	k.	-3, 2	l.	-1, 2
	m.	-6, 2	n.	-1, 5	o.	-2, 1						

## Quadratic Equations 1 ~ Factors

<b>Q1.</b>	a. 0, 5	b. 0, -7	c. 0, 1	d. 0, 3	e. 0, -1	f. 0, 2
	g. 4, 2	h. 3, 4	i. 3, 5	j. -1, -2	k. -4, -5	l. -7, -8
	m. -3, 1	n. -2, 12	o. -1, 9	p. -4, 4	q. -7, 7	r. -5, 5
	s. $\frac{1}{2}, 4$	t. $-2, -\frac{2}{3}$		u. $-\frac{1}{3}, \frac{5}{2}$		
<b>Q2.</b>	a. 0, -4	b. 0, 2	c. 0, -8	d. 0, 1	e. 0, -1	f. 0, -7
	g. 0, -2	h. 0, 4	i. 0, 3	j. $0, \frac{3}{2}$	k. $0, -\frac{3}{2}$	l. $0, -\frac{3}{2}$
	m. 0, 5	n. 0, 9	o. 0, 1	p. $0, \frac{3}{2}$	q. $0, \frac{3}{4}$	r. $0, \frac{2}{5}$
<b>Q3.</b>	a. -5, 5	b. -1, 1	c. -2, 2	d. -6, 6	e. -3, 3	f. -8, 8
	g. -4, 4	h. -12, 12	i. -10, 10	j. -7, 7	k. -9, 9	l. -11, 11
	m. -0.5, 0.5		n. -2.5, 2.5		o. -1.4, 1.4	
	p. -3, 3		q. -4, 4		r. -4, 4	
<b>Q4.</b>	a. -3, -1	b. -5, -1	c. -7, -1	d. -3, -2	e. -4, -2	f. -4, -3
	g. 3, 5	h. 4, 4	i. 2, 5	j. 3, 9	k. 2, 9	l. 4, 6
	m. -4, 2	n. -2, 3	o. -3, 10	p. -7, 2	q. -3, 5	r. -6, 2
<b>Q5.</b>	a. $-2\frac{1}{2}, -1$	b. $-5, -\frac{1}{2}$	c. $-3, -\frac{1}{3}$	d. $-2, -\frac{1}{3}$		
	e. $-1\frac{2}{3}, -1$	f. $-2, -\frac{3}{5}$	g. $\frac{1}{2}, 3$	h. $\frac{2}{3}, 1$		
	i. $\frac{1}{5}, 3$	j. $\frac{2}{3}, 4$	k. $1, 3\frac{1}{2}$	l. $\frac{1}{6}, 1$		
	m. $-\frac{1}{3}, 1$	n. $-2, \frac{3}{4}$	o. $-\frac{1}{2}, 1\frac{1}{2}$	p. $-1\frac{2}{3}, 1$		
	q. $-\frac{1}{4}, \frac{2}{9}$	r. $-\frac{1}{7}, 4$				

## Quadratic Equations 2 ~ Formula

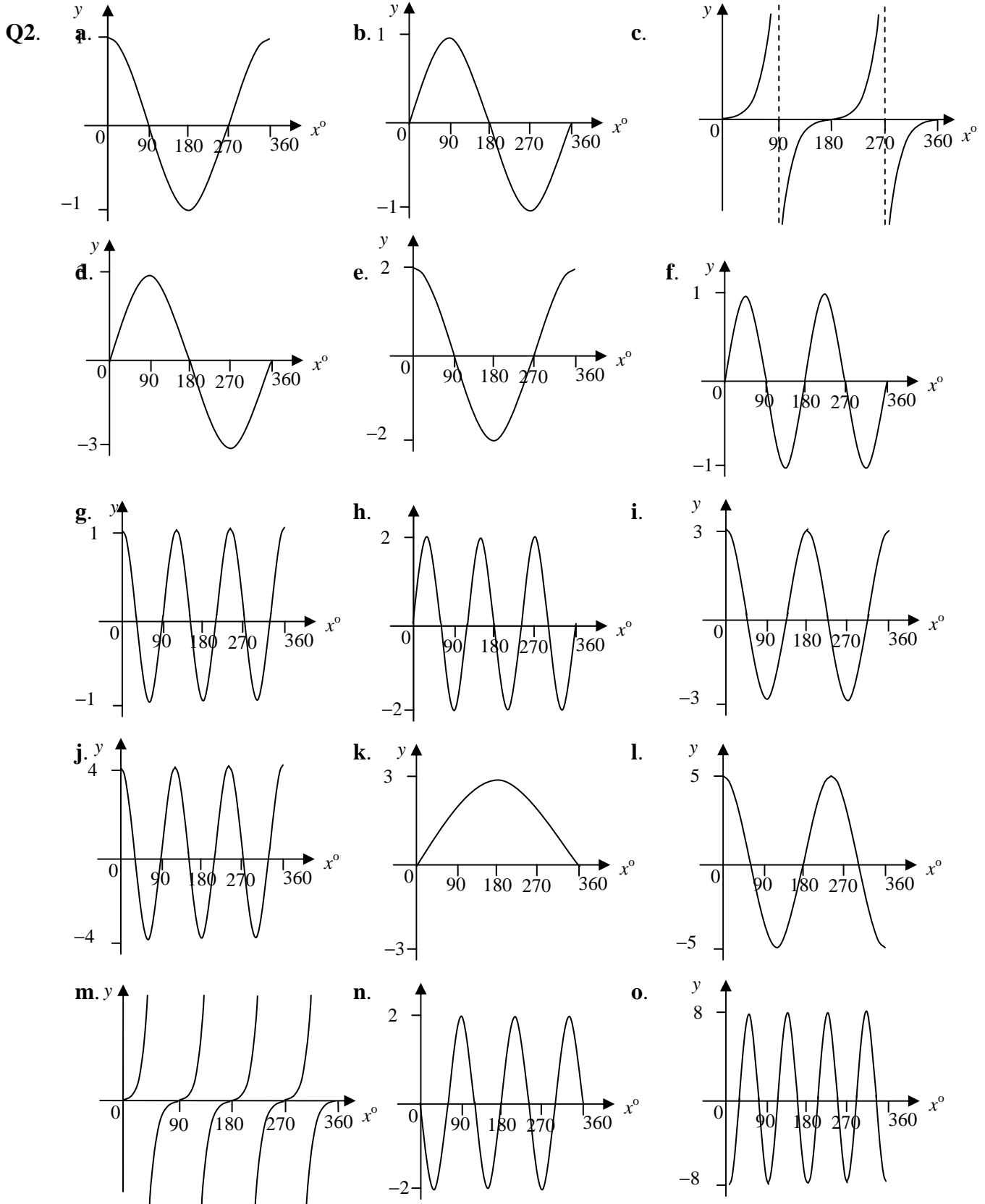
<b>Q1.</b>	a. $-2, -\frac{1}{3}$	b. $-2, -\frac{1}{2}$	c. $-1\frac{2}{3}, -1$	d. $-4\frac{1}{2}, -1$
	e. $-5, -\frac{1}{2}$	f. $-3, -\frac{2}{3}$	g. $\frac{1}{2}, 3$	h. $1, 1\frac{1}{2}$
	i. $\frac{2}{5}, 3$	j. $\frac{2}{5}, 1$	k. $\frac{1}{2}, \frac{2}{3}$	l. $\frac{3}{4}, 2$
	m. $-\frac{1}{3}, 1$	n. $-1, 1.5$	o. $\frac{1}{2}, 1\frac{1}{2}$	p. $-4, \frac{1}{2}$
	q. $-2, \frac{1}{6}$	r. $-4, \frac{2}{3}$		
<b>Q2.</b>	a. -1.38, -3.62	b. -0.23, -8.77	c. -0.27, -3.73	d. -0.59, -3.41
	e. -0.46, -6.54	f. -0.68, -7.32	g. -0.27, -3.73	h. 0.34, 11.66
	i. 0.35, 5.65	j. 0.88, 9.12	k. 0.38, 2.62	l. 0.63, 6.37
	m. -8.36, 0.36	n. -5.16, 1.16	o. -4.16, 2.16	p. -3.37, 2.37
	q. 1.54, 4.54	r. -6.53, 1.53		
<b>Q3.</b>	a. -1.67, -1	b. -4.14, -0.36	c. -2.28, -0.22	d. -1.31, -0.19
	e. -1.77, -0.57	f. -1.54, -0.26	g. 0.18, 0.70	h. 0.28, 2.72
	i. 0.42, 3.58	j. 0.55, 1.45	k. 0.16, 1.24	l. 0.42, 1.58
	m. -1.82, 0.22	n. -1.09, 0.76	o. -0.43, 0.23	p. -2.93, 0.68
	q. -0.90, 0.47	r. -2.68, 1.68		
<b>Q4.</b>	a. -4.30, -0.697	b. -2.62, -0.381	c. -7.74, -0.258	d. -5.79, -1.21
	e. -5.65, -0.354	f. -5.45, -0.551	g. 0.438, 4.56	h. 0.469, 8.53
	i. 0.807, 6.19	j. 0.310, 9.69	k. 1.17, 6.83	l. 0.586, 3.41
	m. -13.5, 1.85	n. -12.2, 1.23	o. -9.74, 1.74	p. -4.85, 1.85
	q. -4.46, 2.46	r. -5.27, 2.27	s. -0.853, -0.146	t. -1.67, 1.07
	u. -0.311, 4.81	v. 0.227, 0.631	w. -2.21, 1.21	x. -1.17, 1.92

## Trigonometry ~ Graphs 1

<b>Q1.</b>	a. $y = 5 \sin x^\circ$	b. $y = 3 \sin x^\circ$	c. $y = 0.5 \sin x^\circ$	d. $y = 4 \cos x^\circ$
	e. $y = 12 \cos x^\circ$	f. $y = \frac{1}{4} \cos x^\circ$	g. $y = 1.5 \sin x^\circ$	h. $y = 2.7 \cos x^\circ$
	i. $y = 3.3 \sin x^\circ$	j. $y = -8 \cos x^\circ$	k. $y = -6 \sin x^\circ$	l. $y = -20 \cos x^\circ$
	m. $y = -2.8 \sin x^\circ$	n. $y = \frac{3}{4} \sin x^\circ$	o. $y = 0.6 \cos x^\circ$	

# Trigonometry ~ Graphs 2

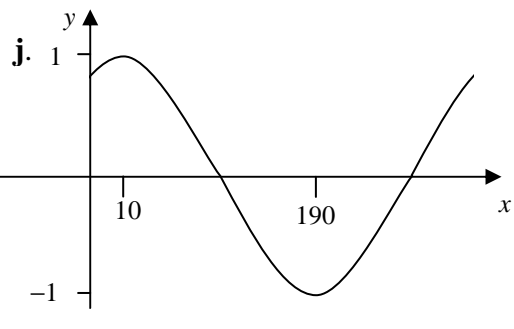
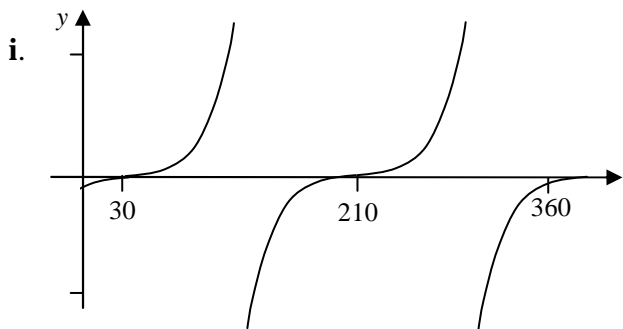
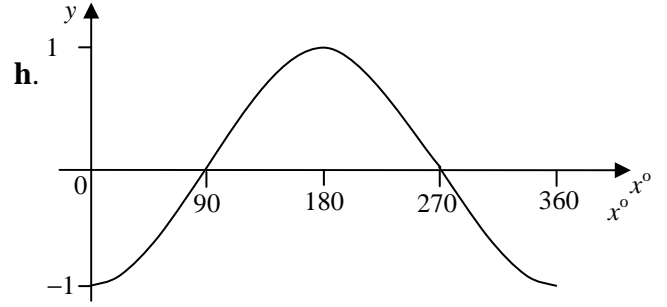
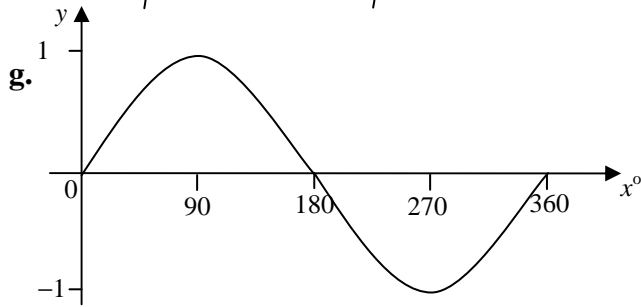
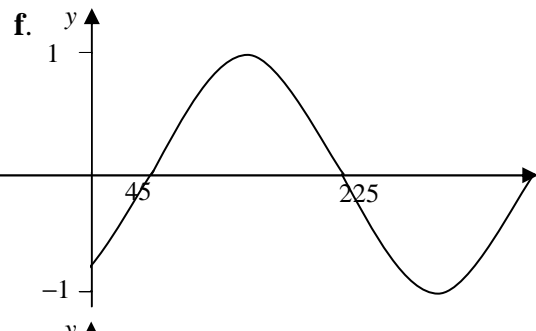
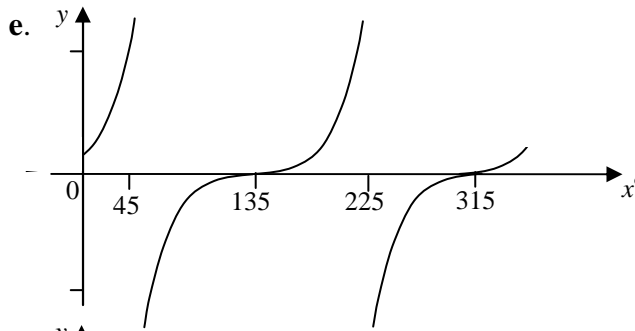
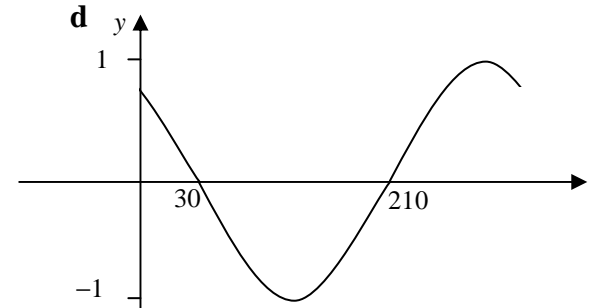
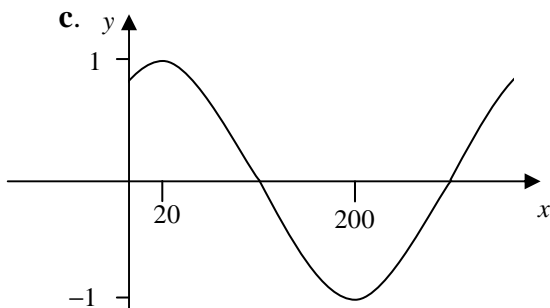
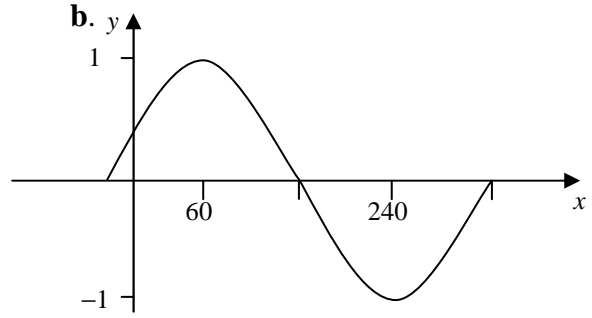
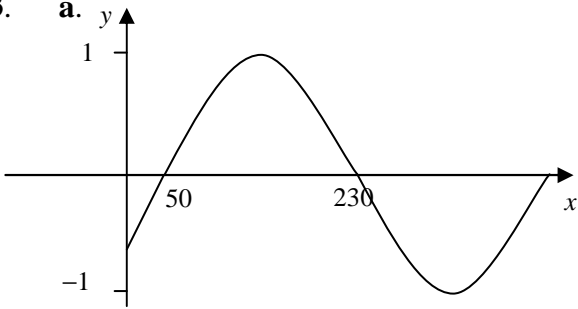
- Q1.** a.  $y = 3 \sin 2x^\circ$     b.  $y = 5 \sin 3x^\circ$     c.  $y = 2 \cos 4x^\circ$     d.  $y = 10 \cos 2x^\circ$   
 e.  $y = 7 \sin 2x^\circ$     f.  $y = 4 \cos 3x^\circ$     g.  $y = -6 \sin 3x^\circ$     h.  $y = -5 \cos 2x^\circ$   
 i.  $y = 3 \sin \frac{1}{2} x^\circ$     j.  $y = 9 \cos \frac{1}{2} x^\circ$     k.  $y = 20 \cos \frac{1}{3} x^\circ$     l.  $y = 3 \cos \frac{3}{2} x^\circ$   
 m.  $y = \tan x^\circ$     n.  $y = \tan 2x^\circ$     o.  $y = \tan \frac{1}{2} x^\circ$     p.  $y = \tan 4x^\circ$

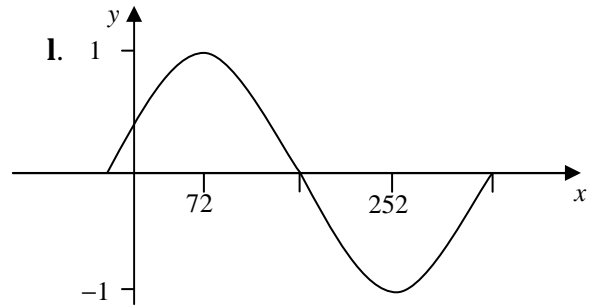
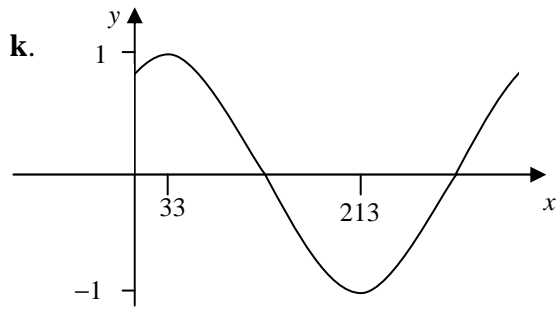


# Trigonometry ~ Graphs 3

- Q1.** a.  $y = \sin(x + 10)^\circ$     b.  $y = \sin(x - 40)^\circ$     c.  $y = \cos(x - 25)^\circ$   
 d.  $y = \cos(x + 30)^\circ$     e.  $y = \sin(x + 15)^\circ$     f.  $y = \cos(x - 30)^\circ$   
 g.  $y = \cos(x + 45)^\circ$     h.  $y = \sin(x - 37)^\circ$     i.  $y = \sin(x - 23)^\circ$   
 j.  $y = \cos(x - 18)^\circ$     b.  $y = 3 \sin(x - 30)^\circ$     c.  $y = 5 \cos(x + 35)^\circ$   
**Q2.** a.  $y = \tan(x - 45)^\circ$     b.  $y = 3 \sin(x - 30)^\circ$     c.  $y = 5 \cos(x + 35)^\circ$   
 d.  $y = 2 \sin(x + 25)^\circ$     e.  $y = 6 \sin(x + 8)^\circ$     f.  $y = 1.5 \cos(x - 25)^\circ$   
 g.  $y = 5 \cos(x - 20)^\circ$     h.  $y = 4 \sin(x + 75)^\circ$

**Q3.**





### Trigonometry ~ Equations

- |     |     |                            |                           |                            |                           |                            |
|-----|-----|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
| Q1. | a.  | $30^\circ, 150^\circ$      | b.                        | $30^\circ, 330^\circ$      | c.                        | $45^\circ, 225^\circ$      |
|     | d.  | $120^\circ, 240^\circ$     | e.                        | $150^\circ, 330^\circ$     | f.                        | $240^\circ, 300^\circ$     |
|     | g.  | $60^\circ, 240^\circ$      | h.                        | $45^\circ, 135^\circ$      | i.                        | $45^\circ, 315^\circ$      |
|     | j.  | $225^\circ, 315^\circ$     | k.                        | $150^\circ, 210^\circ$     | l.                        | $120^\circ, 300^\circ$     |
|     | Q2. | a.                         | $18.2^\circ, 161.8^\circ$ | b.                         | $64.8^\circ, 295.2^\circ$ | c.                         |
|     | d.  | $95^\circ, 265^\circ$      | e.                        | $139^\circ, 319^\circ$     | f.                        | $191^\circ, 349^\circ$     |
|     | g.  | $85^\circ, 265^\circ$      | h.                        | $44^\circ, 136^\circ$      | i.                        | $41^\circ, 319^\circ$      |
|     | j.  | $201^\circ, 339^\circ$     | k.                        | $133^\circ, 227^\circ$     | l.                        | $165^\circ, 345^\circ$     |
| Q3. | a.  | $30^\circ, 150^\circ$      | b.                        | $48.2^\circ, 311.8^\circ$  | c.                        | $59^\circ, 230^\circ$      |
|     | d.  | $120^\circ, 240^\circ$     | e.                        | $104^\circ, 284^\circ$     | f.                        | $228.6^\circ, 311.4^\circ$ |
|     | g.  | $78^\circ, 258^\circ$      | h.                        | $23.6^\circ, 156.4^\circ$  | i.                        | $80.4^\circ, 279.6^\circ$  |
|     | j.  | $202^\circ, 338^\circ$     | k.                        | $144.9^\circ, 215.1^\circ$ | l.                        | $138^\circ, 318^\circ$     |
| Q4. | a.  | $90^\circ$                 | b.                        | $180^\circ$                | c.                        | $45^\circ, 225^\circ$      |
|     | d.  | $210^\circ, 330^\circ$     | e.                        | $60^\circ, 300^\circ$      | f.                        | $26.6^\circ, 206.6^\circ$  |
|     | g.  | $41.4^\circ, 318.6^\circ$  | h.                        | $41.8^\circ, 138.2^\circ$  | i.                        | $113.6^\circ, 246.4^\circ$ |
|     | j.  | $33.7^\circ, 213.7^\circ$  | k.                        | $109.5^\circ, 289.5^\circ$ | l.                        | $205.4^\circ, 334.6^\circ$ |
| Q5. | a.  | $104.5^\circ, 255.5^\circ$ | b.                        | $44.4^\circ, 135.6^\circ$  | c.                        | $84.3^\circ, 264.3^\circ$  |
|     | d.  | $60^\circ, 300^\circ$      | e.                        | $23.6^\circ, 156.4^\circ$  | f.                        | $126.9^\circ, 233.1^\circ$ |
|     | g.  | $45^\circ, 225^\circ$      | h.                        | $120^\circ, 240^\circ$     | i.                        | $53.1^\circ, 126.9^\circ$  |
|     | j.  | $61.9^\circ, 298.1^\circ$  | k.                        | $45.6^\circ, 134.4^\circ$  | l.                        | $60^\circ, 120^\circ$      |

### Trigonometry ~ Periodicity & Identities

- |     |     |                      |    |                    |    |                    |    |              |
|-----|-----|----------------------|----|--------------------|----|--------------------|----|--------------|
| Q1. | a.  | 12                   | b. | 40                 | c. | $120^\circ$        | d. | $90^\circ$   |
|     | e.  | $90^\circ$           | f. | $180^\circ$        | g. | $360^\circ$        | h. | $180^\circ$  |
|     | i.  | $240^\circ$          | j. | $720^\circ$        |    |                    |    |              |
| Q2. | a.  | $180^\circ$          | b. | $90^\circ$         | c. | $180^\circ$        | d. | $60^\circ$   |
|     | e.  | $90^\circ$           | f. | $120^\circ$        | g. | $240^\circ$        | h. | $80^\circ$   |
|     | i.  | $720^\circ$          | j. | $45^\circ$         | k. | $60^\circ$         | l. | $30^\circ$   |
|     | m.  | $20^\circ$           | n. | $40^\circ$         | o. | $12^\circ$         | p. | $24^\circ$   |
|     | q.  | $36^\circ$           | r. | $45^\circ$         |    |                    |    |              |
| Q3. | a.  | $720^\circ$          | b. | $540^\circ$        | c. | $1440^\circ$       | d. | $900^\circ$  |
|     | e.  | $2160^\circ$         | f. | $540^\circ$        | g. | $180^\circ$        | h. | $120^\circ$  |
|     | i.  | $90^\circ$           | j. | $180^\circ$        | k. | $180^\circ$        | l. | $90^\circ$   |
| Q4. | a.  | 3                    | b. | $\sin^2 x$         | c. | $\sin A$           | d. | $5 \cos^2 x$ |
|     | e.  | $\tan a$             | f. | $\frac{2}{\sin x}$ | g. | $\frac{\cos x}{2}$ | h. | $4 \sin x$   |
|     | i.  | $\frac{\cos^2 x}{2}$ | j. | $\sin^2 A$         | k. | $6 \cos^2 B$       | l. | 1            |
|     | m.  | $\sin^2 a$           |    |                    |    |                    |    |              |
|     | Q5. | Proofs               |    |                    |    |                    |    |              |