

Mathematics

There are four sets of exercises at the beginning of this document, together with solutions at the back.

C1**ALGEBRA***Worksheet E***1** Factorise

a $x^2 + 4x + 3$

b $x^2 + 7x + 10$

c $y^2 - 3y + 2$

d $x^2 - 6x + 9$

e $y^2 - y - 2$

f $a^2 + 2a - 8$

g $x^2 - 1$

h $p^2 + 9p + 14$

i $x^2 - 2x - 15$

j $16 - 10m + m^2$

k $t^2 + 3t - 18$

l $y^2 - 13y + 40$

m $r^2 - 16$

n $y^2 - 2y - 63$

o $121 + 22a + a^2$

p $x^2 + 6x - 72$

q $26 - 15x + x^2$

r $s^2 + 23s + 120$

s $p^2 + 14p - 51$

t $m^2 - m - 90$

2 Factorise

a $2x^2 + 3x + 1$

b $2 + 7p + 3p^2$

c $2y^2 - 5y + 3$

d $2 - m - m^2$

e $3r^2 - 2r - 1$

f $5 - 19y - 4y^2$

g $4 - 13a + 3a^2$

h $5x^2 - 8x - 4$

i $4x^2 + 8x + 3$

j $9s^2 - 6s + 1$

k $4m^2 - 25$

l $2 - y - 6y^2$

m $4u^2 + 17u + 4$

n $6p^2 + 5p - 4$

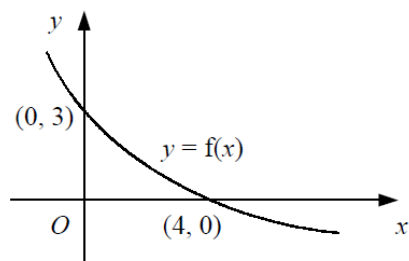
o $8x^2 + 19x + 6$

p $12r^2 + 8r - 15$

1 Describe how the graph of $y = f(x)$ is transformed to give the graph of

- a** $y = f(x - 1)$ **b** $y = f(x) - 3$ **c** $y = 2f(x)$ **d** $y = f(4x)$
e $y = -f(x)$ **f** $y = \frac{1}{5}f(x)$ **g** $y = f(-x)$ **h** $y = f(\frac{2}{3}x)$

2



The diagram shows the curve with equation $y = f(x)$ which crosses the coordinate axes at the points $(0, 3)$ and $(4, 0)$.

Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the graphs of

- a** $y = 3f(x)$ **b** $y = f(x + 4)$ **c** $y = -f(x)$ **d** $y = f(\frac{1}{2}x)$

3 Solve each pair of simultaneous equations.

- | | | |
|--|---|--|
| a $x^2 - y + 3 = 0$
$x - y + 5 = 0$ | b $2x^2 - y - 8x = 0$
$x + y + 3 = 0$ | c $x^2 + y^2 = 25$
$2x - y = 5$ |
| d $x^2 + 2xy + 15 = 0$
$2x - y + 10 = 0$ | e $x^2 - 2xy - y^2 = 7$
$x + y = 1$ | f $3x^2 - x - y^2 = 0$
$x + y - 1 = 0$ |
| g $2x^2 + xy + y^2 = 22$
$x + y = 4$ | h $x^2 - 4y - y^2 = 0$
$x - 2y = 0$ | i $x^2 + xy = 4$
$3x + 2y = 6$ |

6 Express in the form $a + b\sqrt{3}$

- a** $\sqrt{3}(2 + \sqrt{3})$ **b** $4 - \sqrt{3} - 2(1 - \sqrt{3})$ **c** $(1 + \sqrt{3})(2 + \sqrt{3})$
d $(4 + \sqrt{3})(1 + 2\sqrt{3})$ **e** $(3\sqrt{3} - 4)^2$ **f** $(3\sqrt{3} + 1)(2 - 5\sqrt{3})$

7 Simplify

- a** $(\sqrt{5} + 1)(2\sqrt{5} + 3)$ **b** $(1 - \sqrt{2})(4\sqrt{2} - 3)$ **c** $(2\sqrt{7} + 3)^2$
d $(3\sqrt{2} - 1)(2\sqrt{2} + 5)$ **e** $(\sqrt{5} - \sqrt{2})(\sqrt{5} + 2\sqrt{2})$ **f** $(3 - \sqrt{8})(4 + \sqrt{2})$

Solutions

C1 ALGEBRA

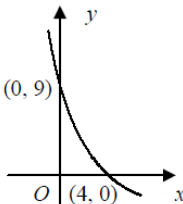
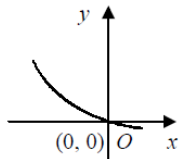
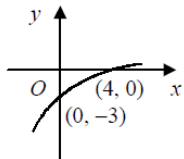
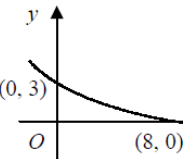
Answers - Worksheet E

- 1
- | | | | | | | | |
|---|---------------|---|---------------|---|---------------|---|---------------|
| a | $(x+1)(x+3)$ | b | $(x+2)(x+5)$ | c | $(y-1)(y-2)$ | d | $(x-3)^2$ |
| e | $(y+1)(y-2)$ | f | $(a+4)(a-2)$ | g | $(x+1)(x-1)$ | h | $(p+2)(p+7)$ |
| i | $(x+3)(x-5)$ | j | $(m-2)(m-8)$ | k | $(t+6)(t-3)$ | l | $(y-5)(y-8)$ |
| m | $(r+4)(r-4)$ | n | $(y+7)(y-9)$ | o | $(a+11)^2$ | p | $(x+12)(x-6)$ |
| q | $(x-2)(x-13)$ | r | $(s+8)(s+15)$ | s | $(p+17)(p-3)$ | t | $(m-10)(m+9)$ |
- 2
- | | | | | | | | |
|---|----------------|---|----------------|---|----------------|---|----------------|
| a | $(2x+1)(x+1)$ | b | $(3p+1)(p+2)$ | c | $(2y-3)(y-1)$ | d | $(2+m)(1-m)$ |
| e | $(3r+1)(r-1)$ | f | $(5+y)(1-4y)$ | g | $(3a-1)(a-4)$ | h | $(5x+2)(x-2)$ |
| i | $(2x+1)(2x+3)$ | j | $(3s-1)^2$ | k | $(2m+5)(2m-5)$ | l | $(2+3y)(1-2y)$ |
| m | $(4u+1)(u+4)$ | n | $(3p+4)(2p-1)$ | o | $(8x+3)(x+2)$ | p | $(6r-5)(2r+3)$ |

C1 GRAPHS OF FUNCTIONS

Answers - Worksheet B

- 1
- | | | | |
|---|--|---|--|
| a | translated 1 unit in positive x -direction | b | translated 3 units in negative y -direction |
| c | stretched by a factor of 2 in y -direction | d | stretched by a factor of $\frac{1}{4}$ in x -direction |
| e | reflected in the x -axis | f | stretched by a factor of $\frac{1}{5}$ in y -direction |
| g | reflected in the y -axis | h | stretched by a factor of $\frac{3}{2}$ in x -direction |

- 2
- | | | | | | | | |
|---|---|---|---|---|--|---|---|
| a |  | b |  | c |  | d |  |
|---|---|---|---|---|--|---|---|

3

a subtracting
 $x^2 - x - 2 = 0$
 $(x + 1)(x - 2) = 0$
 $x = -1$ or 2
 $\therefore x = -1, y = 4$
or $x = 2, y = 7$

b adding
 $2x^2 - 7x + 3 = 0$
 $(2x - 1)(x - 3) = 0$
 $x = \frac{1}{2}$ or 3
 $\therefore x = \frac{1}{2}, y = -\frac{7}{2}$
or $x = 3, y = -6$

c $y = 2x - 5$
sub.
 $x^2 + (2x - 5)^2 = 25$
 $x^2 - 4x = 0$
 $x(x - 4) = 0$
 $x = 0$ or 4
 $\therefore x = 0, y = -5$
or $x = 4, y = 3$

d $y = 2x + 10$
sub.
 $x^2 + 2x(2x + 10) + 15 = 0$
 $x^2 + 4x + 3 = 0$
 $(x + 3)(x + 1) = 0$
 $x = -3$ or -1
 $\therefore x = -3, y = 4$
or $x = -1, y = 8$

e $y = 1 - x$
sub.
 $x^2 - 2x(1 - x) - (1 - x)^2 = 7$
 $x^2 = 4$
 $x = \pm 2$
 $\therefore x = -2, y = 3$
or $x = 2, y = -1$

f $y = 1 - x$
sub.
 $3x^2 - x - (1 - x)^2 = 0$
 $2x^2 + x - 1 = 0$
 $(2x - 1)(x + 1) = 0$
 $x = -1$ or $\frac{1}{2}$
 $\therefore x = -1, y = 2$
or $x = \frac{1}{2}, y = \frac{1}{2}$

g $y = 4 - x$
sub.
 $2x^2 + x(4 - x) + (4 - x)^2 = 22$
 $x^2 - 2x - 3 = 0$
 $(x + 1)(x - 3) = 0$
 $x = -1$ or 3
 $\therefore x = -1, y = 5$
or $x = 3, y = 1$

h $x = 2y$
sub.
 $(2y)^2 - 4y - y^2 = 0$
 $3y^2 - 4y = 0$
 $y(3y - 4) = 0$
 $y = 0$ or $\frac{4}{3}$
 $\therefore x = 0, y = 0$
or $x = \frac{8}{3}, y = \frac{4}{3}$

i $y = 3 - \frac{3}{2}x$
sub.
 $x^2 + x(3 - \frac{3}{2}x) = 4$
 $x^2 - 6x + 8 = 0$
 $(x - 2)(x - 4) = 0$
 $x = 2$ or 4
 $\therefore x = 2, y = 0$
or $x = 4, y = -3$

6

a $= 3 + 2\sqrt{3}$

b $= 4 - \sqrt{3} - 2 + 2\sqrt{3}$
 $= 2 + \sqrt{3}$

c $= 2 + \sqrt{3} + 2\sqrt{3} + 3$
 $= 5 + 3\sqrt{3}$

d $= 4 + 8\sqrt{3} + \sqrt{3} + 6$
 $= 10 + 9\sqrt{3}$

e $= 27 - 24\sqrt{3} + 16$
 $= 43 - 24\sqrt{3}$

f $= 6\sqrt{3} - 45 + 2 - 5\sqrt{3}$
 $= -43 + \sqrt{3}$

7

a $= 10 + 3\sqrt{5} + 2\sqrt{5} + 3$
 $= 13 + 5\sqrt{5}$

b $= 4\sqrt{2} - 3 - 8 + 3\sqrt{2}$
 $= 7\sqrt{2} - 11$

c $= 28 + 12\sqrt{7} + 9$
 $= 37 + 12\sqrt{7}$

d $= 12 + 15\sqrt{2} - 2\sqrt{2} - 5$
 $= 7 + 13\sqrt{2}$

e $= 5 + 2\sqrt{10} - \sqrt{10} - 4$
 $= 1 + \sqrt{10}$

f $= (3 - 2\sqrt{2})(4 + \sqrt{2})$
 $= 12 + 3\sqrt{2} - 8\sqrt{2} - 4$
 $= 8 - 5\sqrt{2}$