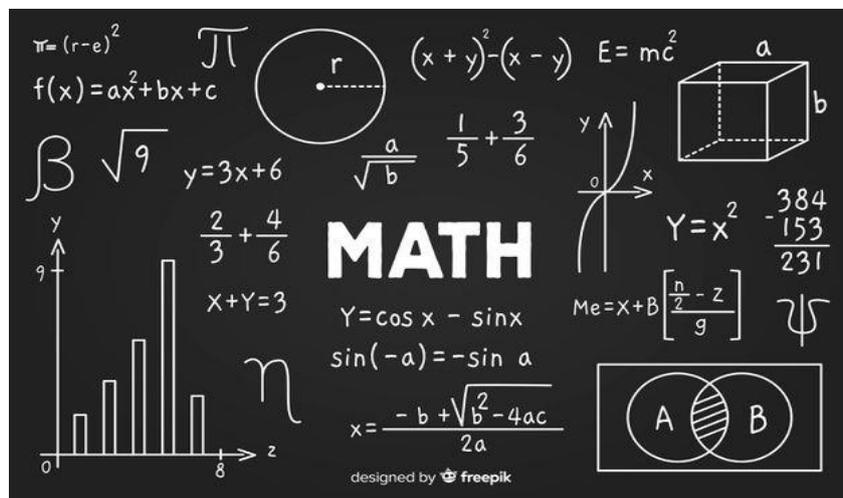




# Higham Lane School

A Level Maths

Transitional Skills - ANSWER BOOKLET



## Indices

### Ex A

- 1)  $5b^6$   
2)  $6c^7$

- 3)  $b^3c^4$   
4)  $-12n^8$

- 5)  $4n^5$   
6)  $d^2$

- 7)  $a^6$   
8)  $-d^{12}$

### Ex B

- 1) 2  
2) 3  
3)  $1/3$

- 4)  $1/25$   
5) 1  
6)  $1/7$

- 7) 9  
8)  $9/4$   
9)  $1/4$

- 10) 0.2  
11)  $4/9$   
12) 64

- 13)  $6a^3$   
14)  $x$   
15)  $xy^2$

## Problem Solving

1) 33

4) 11.625

2) 6.5

5) 7 or -1

3)  $-3\frac{2}{3}$

6) 2

## Surds

### Ex A

- 1)  $5\sqrt{2}$   
2)  $6\sqrt{2}$

- 3)  $3\sqrt{3}$   
4)  $4\sqrt{5}$

- 5)  $6\sqrt{10}$   
6)  $10\sqrt{3}$

### Ex B

- 1)  $\sqrt{21}$   
2)  $20\sqrt{10}$   
3)  $18\sqrt{2}$

- 4)  $6\sqrt{6}$   
5)  $\frac{5}{3}$   
6) 6

- 7)  $7 + 6\sqrt{2}$   
8)  $5\sqrt{2} - 40 - \sqrt{6} + 8\sqrt{3}$

### Ex C

- 1)  $\sqrt{3} + \sqrt{7}$   
2)  $9\sqrt{2}$   
3)  $5\sqrt{6}$

- 4)  $7\sqrt{2}$   
5)  $8\sqrt{3}$   
6)  $\sqrt{5}$

- 7)  $\sqrt{2}$   
8)  $7\sqrt{3}$   
9)  $3\sqrt{2} + 3\sqrt{10}$

10)  $6\sqrt{2} + \sqrt{3}$

### Ex D

1

- a)  $\frac{\sqrt{2}}{2}$   
b)  $\frac{3\sqrt{5}}{5}$   
c)  $2\sqrt{5}$

- d)  $\frac{5\sqrt{7}}{14}$   
e)  $\frac{\sqrt{6}}{2}$   
f)  $\sqrt{10}$

- g)  $\frac{4\sqrt{3} + \sqrt{21}}{3}$   
h)  $3\sqrt{2} + 4\sqrt{5}$   
i)  $\frac{6\sqrt{5} - 5}{5}$

2

- a)  $\sqrt{2} + 1$   
b)  $\sqrt{6} + 2$

- c)  $2(\sqrt{7} - 2)$   
d)  $\frac{1}{4}(3 - \sqrt{5})$

e)  $\sqrt{6} + \sqrt{5}$

## Surds – problem solving

### Task 1

$$\text{Area} = 16\text{cm} \quad x=4\sqrt{4} \quad 15 + 8\sqrt{5} \quad \text{Perimeter} = 30 + 10\sqrt{5}$$

### Task 2

a) Length of perpendicular side =  $\frac{14}{4+\sqrt{2}}$       b)  $c^2 = (4 + \sqrt{2})^2 + (4 - \sqrt{2})^2$   
Attempt to multiply by  $\frac{4-\sqrt{2}}{4-\sqrt{2}}$        $c^2 = 16 + 8\sqrt{2} + 2 + 16 - 8\sqrt{2} + 2$   
 $\frac{56 - 14\sqrt{2}}{16 - 2}$        $c^2 = 36$   
 $(4 - \sqrt{2})\text{cm}$        $c = 6\text{cm}$

### Task 3

a) i. Common ratio =  $\sqrt{3}$       b) Common ratio =  $\sqrt{2}$   
ii. 18,  $18\sqrt{3}$ , 54      nth term =  $(\sqrt{2})^{n-1}$

## Factoring

### Exercise A

1)  $x(3 + y)$       4)  $3q(p - 3q)$       7)  $(y - 1)(5y + 3)$   
2)  $2x(2x - y)$       5)  $2x^2(x - 3)$   
3)  $pq(q - p)$       6)  $4a^3b^2(2a^2 - 3b^2)$

### Exercise B

1)  $(x - 3)(x + 2)$       6)  $(2y + 3)(y + 7)$       11)  $4(x - 2)(x - 1)$   
2)  $(x + 8)(x - 2)$       7)  $(7y - 3)(y - 1)$       12)  $(4m - 9n)(4m + 9n)$   
3)  $(2x + 1)(x + 2)$       8)  $5(2x - 3)(x + 2)$       13)  $y(2y - 3)(2y + 3)$   
4)  $x(2x - 3)$       9)  $(2x + 5)(2x - 5)$       14)  $2(4x + 5)(x - 4)$   
5)  $(3x - 1)(x + 2)$       10)  $(x - 3)(x - y)$

## Problem solving

### Task 1

$6x^2 + 3x = 3x(2x + 1)$ There are a number of possible answers, including the length is $3x$ and the width is $2x + 1$ (or vice versa).	$x^2 + 8x - 20 = (x + 10)(x - 2)$ The length is $x + 10$ and the width is $x - 2$ (or vice versa). $x$ must be larger than 2.
---	--

## Task 2

$$(x - 3)(x - 4)$$

$$\text{Area} \quad (2x+1)(3x-2)$$

$$9x^2 + 12x + 4$$

Perimeter of the square = 32 cm

## Rearranging Formula

Ex A

$$1) \quad x = \frac{y+1}{7}$$

$$2) \quad x = 4y - 5$$

$$3) \quad x = 3(4y + 2)$$

$$4) \quad x = \frac{9y+20}{12}$$

Ex B

$$1) \quad t = \frac{32rP}{w}$$

$$4) \quad t = \frac{P^2g}{2}$$

$$6) \quad t = \pm \sqrt{\frac{r-a}{b}}$$

$$2) \quad t = \pm \sqrt{\frac{32rP}{w}}$$

$$5) \quad t = v - \frac{Pag}{w}$$

$$3) \quad t = \pm \sqrt{\frac{3V}{\pi h}}$$

Ex C

$$1) \quad x = \frac{c-3}{a-b}$$

$$2) \quad x = \frac{3a+2k}{k-3}$$

$$4) \quad x = \frac{ab}{b-a}$$

$$3) \quad x = \frac{2y+3}{5y-2}$$

## Challenge questions

$$1 \quad \sin B = \frac{b \sin A}{a}$$

$$2 \quad \cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$3 \quad \text{a} \quad x = \frac{q+pt}{q-ps}$$

$$\text{b} \quad x = \frac{3py+2pqy}{3p-apq} = \frac{y(3+2q)}{3-aq}$$

## Completing the Square

### Exercise A

- |                      |  |  |
|----------------------|--|--|
| 1 (a) $(x+4)^2 + 3$  | (b) $(x-5)^2 - 2$                      | (c) $(x+1)^2 - 5$                        |
| (d) $(x-2)^2 - 7$    | (e) $(x-1\frac{1}{2})^2 - \frac{1}{4}$ | (f) $(x-2\frac{1}{2})^2 - 12\frac{1}{4}$ |
| 2 (a) $3(x+1)^2 + 4$ | (b) $5(x-2)^2 - 3$                     | (c) $2(x+2\frac{1}{2})^2 + \frac{1}{2}$  |
| 3 (a) $(2x+3)^2 + 5$ | (b) $(3x-2)^2 - 5$                     | (c) $(4x+5)^2 - 3$                       |

### Finding turning points

#### Exercise B

1. (a) (4, 4) (b) (5, -26) (c) (-2, -10)

## Solving Quadratic Equations

### Exercise A

- |                               |                             |
|-------------------------------|-----------------------------|
| 1 a $x=0$ or $x=-\frac{2}{3}$ | b $x=0$ or $x=\frac{3}{4}$  |
| c $x=-5$ or $x=-2$            | d $x=2$ or $x=3$            |
| e $x=-1$ or $x=4$             | f $x=-5$ or $x=2$           |
| g $x=4$ or $x=6$              | h $x=-6$ or $x=6$           |
| i $x=-7$ or $x=4$             | j $x=3$                     |
| k $x=-\frac{1}{2}$ or $x=4$   | l $x=-\frac{2}{3}$ or $x=5$ |
| 2 a $x=-2$ or $x=5$           | b $x=-1$ or $x=3$           |
| c $x=-8$ or $x=3$             | d $x=-6$ or $x=7$           |
| e $x=-5$ or $x=5$             | f $x=-4$ or $x=7$           |
| g $x=-3$ or $x=2\frac{1}{2}$  | h $x=-\frac{1}{3}$ or $x=2$ |

### Exercise B

- |  |  |
|--|--|
| 1 a $x=2+\sqrt{7}$ or $x=2-\sqrt{7}$                     | b $x=5+\sqrt{21}$ or $x=5-\sqrt{21}$                         |
| c $x=-4+\sqrt{21}$ or $x=-4-\sqrt{21}$                   | d $x=1+\sqrt{7}$ or $x=1-\sqrt{7}$                           |
| e $x=-2+\sqrt{6.5}$ or $x=-2-\sqrt{6.5}$                 | f $x=\frac{-3+\sqrt{89}}{10}$ or $x=\frac{-3-\sqrt{89}}{10}$ |
| 2 a $x=1+\sqrt{14}$ or $x=1-\sqrt{14}$                   | b $x=\frac{-3+\sqrt{23}}{2}$ or $x=\frac{-3-\sqrt{23}}{2}$   |
| c $x=\frac{5+\sqrt{13}}{2}$ or $x=\frac{5-\sqrt{13}}{2}$ |  |

### Exercise C

1 a  $x = -1 + \frac{\sqrt{3}}{3}$  or  $x = -1 - \frac{\sqrt{3}}{3}$       b  $x = 1 + \frac{3\sqrt{2}}{2}$  or  $x = 1 - \frac{3\sqrt{2}}{2}$

2  $x = \frac{7 + \sqrt{41}}{2}$  or  $x = \frac{7 - \sqrt{41}}{2}$

3  $x = \frac{-3 + \sqrt{89}}{20}$  or  $x = \frac{-3 - \sqrt{89}}{20}$

### Challenge

a  $x = \frac{7 + \sqrt{17}}{8}$  or  $x = \frac{7 - \sqrt{17}}{8}$

b  $x = -1 + \sqrt{10}$  or  $x = -1 - \sqrt{10}$

c  $x = -1\frac{2}{3}$  or  $x = 2$

### Solving Linear Equations

#### Ex A

1) 7                      2) 3                      3)  $1\frac{1}{2}$                       4) 2                      5)  $-\frac{3}{5}$                       6)  $-\frac{7}{3}$

#### Ex B

1) 2.4                      2) 5                      3) 1                      4)  $\frac{1}{2}$

#### Ex C

1) 7                                      3)  $\frac{24}{7}$                                       5) 3                                      7)  $\frac{9}{5}$   
2) 15                                      4)  $\frac{35}{3}$                                       6) 2                                      8) 5

### Challenge

1) 34, 36, 38

2)  $9\frac{7}{8}$  and  $29\frac{5}{8}$

### Problem Solving

Task 1 – Isosceles (65, 65, 50)

Task 2 – 21 tokens

## Solving Simultaneous Equations

### Ex A

1  $x = 1, y = 4$

4  $x = 3, y = -\frac{1}{2}$

2  $x = 3, y = -2$

5  $x = 6, y = -1$

3  $x = 2, y = -5$

6  $x = -2, y = 5$

### Ex B

1  $x = 1, y = 3$

5  $x = 3, y = 4$

9  $x = -2, y = -4$

$x = -\frac{9}{5}, y = -\frac{13}{5}$

$x = 2, y = 1$

$x = 2, y = 4$

2  $x = 2, y = 4$

6  $x = 7, y = 2$

10  $x = \frac{5}{2}, y = 6$

$x = 4, y = 2$

$x = -1, y = -6$

$x = 3, y = 5$

3  $x = 1, y = -2$

7  $x = 0, y = 5$

$x = 2, y = -1$

$x = -5, y = 0$

4  $x = 4, y = 1$

8  $x = -\frac{8}{3}, y = -\frac{19}{3}$

$x = \frac{16}{5}, y = \frac{13}{5}$

$x = 3, y = 5$

### Challenge

- 1  $(2, 1), (-\frac{5}{9}, -\frac{14}{9})$
- 2  $(-1, -2), (\frac{38}{13}, -\frac{9}{13})$
- 3  $(\frac{5}{3}, \frac{1}{3}), (-\frac{3}{5}, -\frac{4}{5})$
- 4  $(2, -2)$  (only)
- 5  $(6, -5)$  (only)
- 6  $(6, 1), (\frac{14}{3}, \frac{7}{3})$

### Problem Solving

#### Task 1

1. L is the number of stickers that Laura has; D is the number of stickers that Dora has.  
 $L + D = 87$   
 $L - D = 9; L = D + 9$   
 $L = 48, D = 39$
2.  $17 \times 5$  pence pieces.  $23 \times 10$  pence pieces.
3. The original shape measures 11cm by 19cm.
4. A pencil case takes 0.75 hours to make and a makeup bag takes 1.25 hours to make.



## Challenge

- 1    **a**   Parallel                      **b**   Neither                      **c**   Perpendicular  
       **d**   Perpendicular                **e**   Neither                      **f**   Parallel
- 2    **a**    $x + 2y - 4 = 0$                 **b**    $x + 2y + 2 = 0$                 **c**    $y = 2x$

## Problem Solving

### Task 1

**Question 1.** Students may first put the equation into the form  $y = mx + b$  and look for  $m$ , the slope.

$y + 2x = 8$ $y = -2x + 8$ Slope = $-2$	$2y + \frac{1}{2}x + 1 = 0$ $y = -\frac{1}{4}x - \frac{1}{2}$ Slope = $-\frac{1}{4}$	$2y + x = 1$ $y = -\frac{1}{2}x + \frac{1}{2}$ Slope = $-\frac{1}{2}$	$y = x - 4$ Slope = $1$	$y = 2(x - 1)$ $y = 2x - 2$ Slope = $2$
$2y = x - 4$ $y = \frac{1}{2}x - 2$ Slope = $\frac{1}{2}$	$y + 2x + 2 = 0$ $y = -2x - 2$ Slope = $-2$	$y = \frac{1}{2}x + 2$ Slope = $\frac{1}{2}$	$y = 4 - x$ $y = -x + 4$ Slope = $-1$	$2y = 4 - x$ $y = -\frac{1}{2}x + 2$ Slope = $-\frac{1}{2}$

The slopes of parallel lines are equal. The product of the slope of a line and its perpendicular is  $-1$ .

These pairs of lines are parallel:     $y + 2x = 8$  and  $y + 2x + 2 = 0$   
     $2y = x - 4$  and  $y = \frac{1}{2}x + 2$   
     $2y + x = 1$  and  $2y = 4 - x$

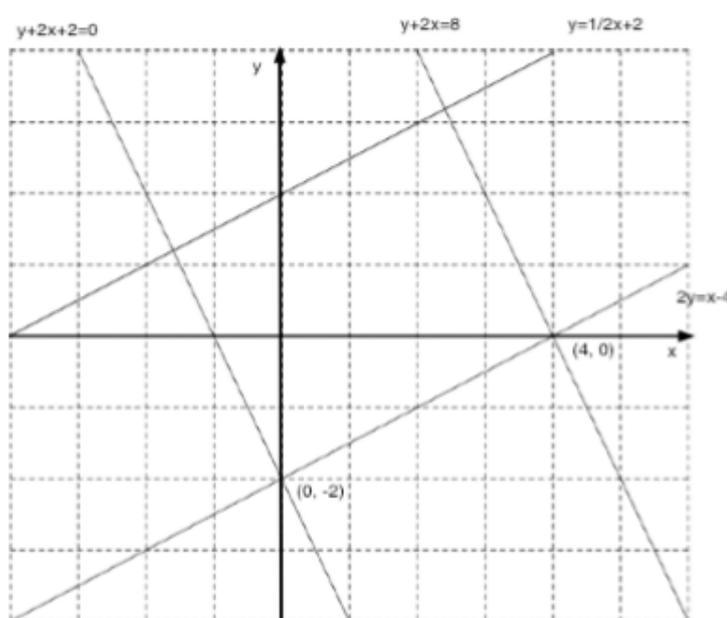
Lines  $y + 2x = 8$  and  $y + 2x + 2 = 0$  are perpendicular to  $2y = x - 4$  and  $y = \frac{1}{2}x + 2$  so these form a rectangle.

**Question 2.** Lines  $y + 2x = 8$  and  $y + 2x + 2 = 0$  have a negative slope, so they are the parallel pair shown on the diagram.

Lines  $2y = x - 4$  and  $y = \frac{1}{2}x + 2$  have a positive slope so either  $2y = x - 4$  or  $y = \frac{1}{2}x + 2$  is the line that is missing.

The  $y$  intercepts of lines  $2y = x - 4$  and  $y + 2x + 2 = 0$  are the same so these lines cross and intercept the  $y$ -axis at the point  $(0, -2)$ .

Line  $y = \frac{1}{2}x + 2$  can be positioned by finding the line that is parallel to  $2y = x - 4$  that passes through  $(0, 2)$  ( $y$ -intercept).



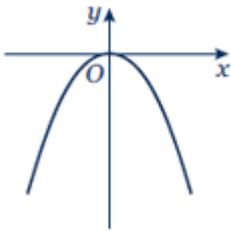
## Task 2

$$4x+3y=24 \text{ therefore } y=-3/4x+8$$

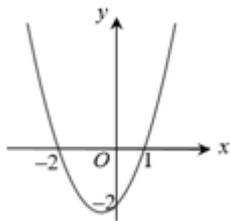
## Quadratic Graphs

### Ex A

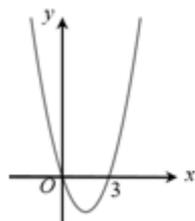
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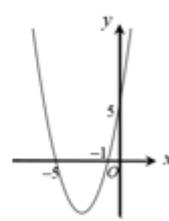
2 a



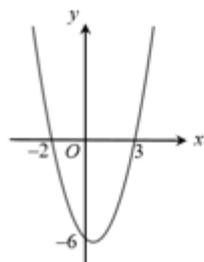
b



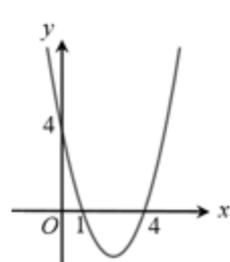
c



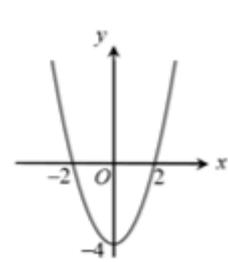
3 a



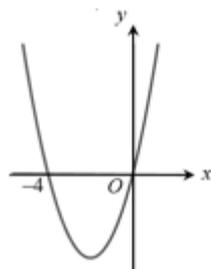
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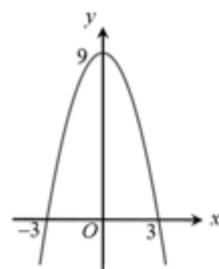
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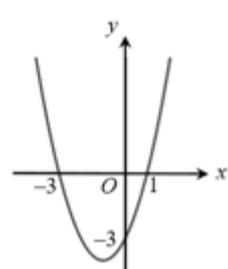
d



e

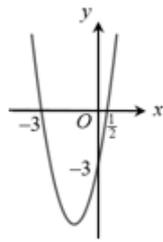


f

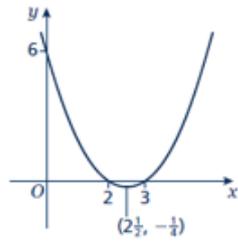


## Challenge

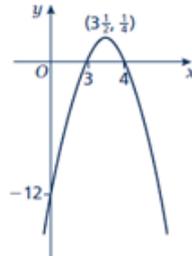
1



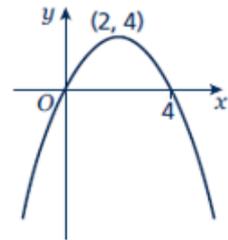
2 a



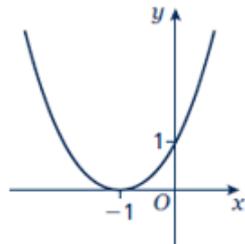
b



c



3

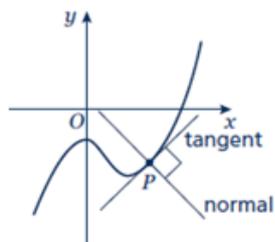


## Other Graphs

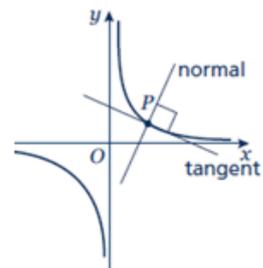
### Ex A

- 1 a
- i - C
  - ii - E
  - iii - B
  - iv - A
  - v - F
  - vi - D

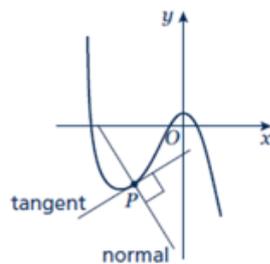
b ii



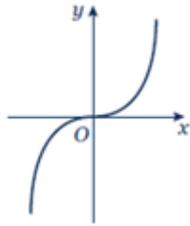
iv



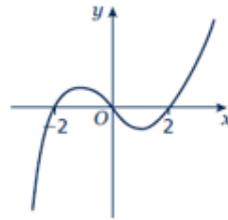
vi



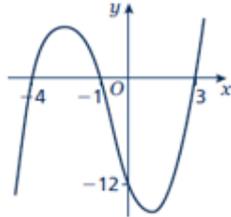
2



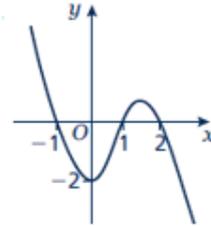
3



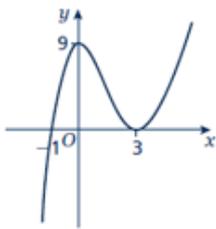
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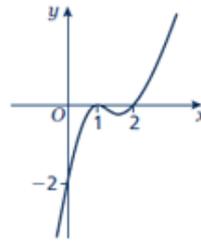
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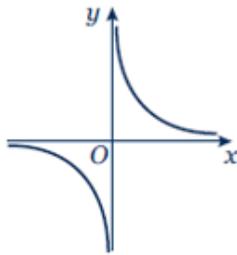
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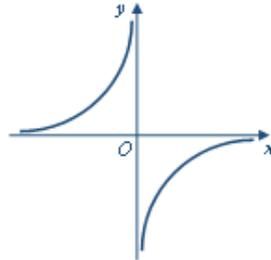
7



8

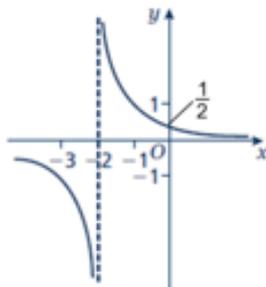


9

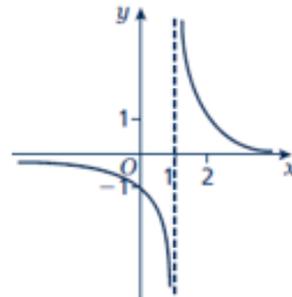


### Challenge

1



2



## Inequalities

### Ex A

- |          |                             |                               |                      |
|----------|-----------------------------|-------------------------------|----------------------|
| <b>1</b> | <b>a</b> $x > 4$            | <b>b</b> $x \leq 2$           | <b>c</b> $x \leq -1$ |
|          | <b>d</b> $x > -\frac{7}{2}$ | <b>e</b> $x \geq 10$          | <b>f</b> $x < -15$   |
| <b>2</b> | <b>a</b> $x < -20$          | <b>b</b> $x \leq 3.5$         | <b>c</b> $x < 4$     |
| <b>3</b> | <b>a</b> $x \leq -4$        | <b>b</b> $-1 \leq x < 5$      | <b>c</b> $x \leq 1$  |
|          | <b>d</b> $x < -3$           | <b>e</b> $x > 2$              | <b>f</b> $x \leq -6$ |
| <b>4</b> | <b>a</b> $t < \frac{5}{2}$  | <b>b</b> $n \geq \frac{7}{5}$ |                      |
| <b>5</b> | <b>a</b> $x < -6$           | <b>b</b> $x < \frac{3}{2}$    |                      |

### Challenge

$x > 5$  (which also satisfies  $x > 3$ )

### Ex B

- $-7 \leq x \leq 4$
- $x \leq -2$  or  $x \geq 6$
- $\frac{1}{2} < x < 3$
- $x < -\frac{3}{2}$  or  $x > \frac{1}{2}$
- $-3 \leq x \leq 4$
- $-3 \leq x \leq 2$
- $2 < x < 2\frac{1}{2}$
- $x \leq -\frac{3}{2}$  or  $x \geq \frac{5}{3}$

## Problem Solving

### Task 1

(b)  $50 \leq 4x - 20 \leq 120$       (c)  $18 \leq x \leq 35$

### Task 2

(a)  $A = 8x^2$       (b)  $2 \leq x \leq 5$       (c) 20      (d) 4

## Trigonometry

### Ex A

- 1    **a**     $18\sqrt{13}$  mm                      **b**     $2\sqrt{145}$  mm  
      **c**     $42\sqrt{2}$  mm                        **d**     $6\sqrt{89}$  mm
- 2    95.3 mm

### Challenge

- 1    64.0 km
- 2     $3\sqrt{5}$  units
- 3     $4\sqrt{3}$  cm

### Ex B

- 1    **a**    6.49 cm                      **b**    6.93 cm                      **c**    2.80 cm
- 2    **a**     $36.9^\circ$                       **b**     $57.1^\circ$                       **c**     $47.0^\circ$

### Challenge

- 1    5.71 cm
- 2     $20.4^\circ$
- 3    **a**     $45^\circ$                         **b**    1 cm

### Ex C

- |          |          |         |          |         |          |         |
|----------|----------|---------|----------|---------|----------|---------|
| <b>1</b> | <b>a</b> | 4.33 cm | <b>b</b> | 15.0 cm | <b>c</b> | 45.2 mm |
| <b>2</b> | <b>a</b> | 42.8°   | <b>b</b> | 52.8°   | <b>c</b> | 53.6°   |

### Challenge

- |          |          |         |          |       |
|----------|----------|---------|----------|-------|
| <b>1</b> | <b>a</b> | 8.13 cm | <b>b</b> | 32.3° |
|----------|----------|---------|----------|-------|

### Problem Solving

1. 59.0° or 121.0°

### Ex D

- |          |          |         |          |         |          |         |
|----------|----------|---------|----------|---------|----------|---------|
| <b>1</b> | <b>a</b> | 6.46 cm | <b>b</b> | 9.26 cm | <b>c</b> | 70.8 mm |
| <b>2</b> | <b>a</b> | 22.2°   | <b>b</b> | 52.9°   | <b>c</b> | 122.9°  |

### Challenge

- |          |          |         |          |       |
|----------|----------|---------|----------|-------|
| <b>1</b> | <b>a</b> | 13.7 cm | <b>b</b> | 76.0° |
|----------|----------|---------|----------|-------|

### Ex E

- |          |          |                      |          |                      |          |                     |
|----------|----------|----------------------|----------|----------------------|----------|---------------------|
| <b>1</b> | <b>a</b> | 18.1 cm <sup>2</sup> | <b>b</b> | 18.7 cm <sup>2</sup> | <b>c</b> | 693 mm <sup>2</sup> |
| <b>2</b> |          | 5.10 cm              |          |                      |          |                     |

### Ex F

- |          |     |             |     |             |     |             |
|----------|-----|-------------|-----|-------------|-----|-------------|
| <b>1</b> | (a) | 64.2, 115.8 | (b) | 53.1, 306.9 | (c) | 63.4, 243.4 |
|----------|-----|-------------|-----|-------------|-----|-------------|