KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 10

2025 Mathematics 2026

Unit 18 Booklet – Part 1

HGS Maths

Tasks

Dr Frost Course

Name: _____

Class: _____

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Unit 18 Booklet – Part 2

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Dr Frost Course

Name: _____

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Contents Page

1 Advanced Data Handling

Quartiles

Worked Example	Your Turn
Find the lower quartile, upper quartile and interquartile range for: 1 2 2 3 3 4 5 5 6 6 8 8 12 13 16 16 16 17 18 18 18 19 20	Find the lower quartile, upper quartile and interquartile range for 1 2 8 8 9 9 9 10 10 10 10 12 13 14 14 14 15 16 17 17 18 18 18 18 18 18 20

Dr Frost 396a and 396b

Fill in the Gaps

Data Set											Median	Lower Quartile	Upper Quartile	Interquartile Range
3	3	4	5	5	6	6	8	10	10	10	6	4	10	
6	6	6	7	7	8	10	10	11	11	12	8	6		
1	2	3	3	5	7	7	7	8	9	9				
4	4	4	4	5	5	5	5	6	6	6				
0.2	0.4	0.5	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.1				
7	8	8	9	10	10	11	12	12				8	11.5	
14	14	16	17	17	18	18	19	20						
1.7	1.8	2.0	2.1	2.1	2.2	2.3	2.5	2.5						
5	6		7	9		10	11		12	12	10	6	11	
5			7	7	8		8		9	10			9	4
18	18		22			23		27			23	19	24	
8.2		8.4	8.5		8.7	8.7		9.1			8.5	8.3	8.75	

Mode of Ungrouped Data

Worked Example

Determine the modal score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	4

Your Turn

Determine the modal score:

Score	Frequency
0	4
1	6
2	2
3	4
4	4
5	8

Range of Ungrouped Data

Worked Example

Determine the range of the scores:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	4

Your Turn

Determine the range of the scores:

Score	Frequency
0	4
1	6
2	2
3	4
4	4
5	8

Median of Ungrouped Data

Fluency Practice

Number of pieces of data: | Position of the median:

(a) 4, 10, 11, 12, 12, 15, 20

(b) 4, 10, 11, 12, 12, 15

(c) 10, 11, 12, 12, 15

(d) 10, 11, 12, 12

(e) 1, 3, 6, 8, 9, 12

Number of pieces of data:	Position of the median:
7	
11	
10	
41	
24	
	8
	3.5
	40
	21.5

Fluency Practice

Number of pets	Frequency	Which pieces of data are in this category?
0	3	1st 2nd 3rd
1	2	4th 5th
2	4	

Number of pets	Frequency	Which pieces of data are in this category?
0	5	
1	1	
2	3	

Number of pets	Frequency	Which pieces of data are in this category?
0	2	
1	1	
2	5	

Number of pets	Frequency	Which pieces of data are in this category?
0	1	
1	3	
2	3	

Number of pets	Frequency	Which pieces of data are in this category?
0		1st 2nd
1		3rd
2		4th 5th 6th 7th 8th
3		9th 10th
4		11th 12th 13th

Number of pets	Frequency	Which pieces of data are in this category?
0		1st
1		2nd 3rd 4th
2		5th 6th 7th 8th
3		9th 10th
4		11th 12th

Number of pets	Frequency	Which pieces of data are in this category?
0	21	1st to 21st
1	15	22nd to...
2	18	
3	25	
4	32	

Number of pets	Frequency	Which pieces of data are in this category?
0	10	
1	12	
2	15	
3	20	
4	5	

Number of pets	Frequency	Which pieces of data are in this category?
0	8	
1	9	
2	13	
3	12	
4	9	

Number of pets	Frequency	Which pieces of data are in this category?
0		1st to 13th
1		14th to 29th
2		30th to 59th
3		60th to 80th
4		81st to 92nd

Worked Example

Calculate the median score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	7

Your Turn

Calculate the median score:

Score	Frequency
0	9
1	6
2	2
3	4
4	4
5	8

Worked Example

Calculate the median score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	4

Your Turn

Calculate the median score:

Score	Frequency
0	4
1	6
2	2
3	4
4	4
5	8

Worked Example

Calculate the median score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	2

Your Turn

Calculate the median score:

Score	Frequency
0	8
1	6
2	2
3	4
4	4
5	8

Quartiles of Ungrouped Data

Worked Example

Calculate the lower quartile and upper quartile score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	9

Your Turn

Calculate the lower quartile and upper quartile score:

Score	Frequency
0	7
1	6
2	2
3	4
4	4
5	8

Mean of Ungrouped Data

Worked Example

Calculate the total score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	4

Your Turn

Calculate the total score:

Score	Frequency
0	4
1	6
2	2
3	4
4	4
5	8

Worked Example

Calculate the mean score:

Score	Frequency
0	2
1	3
2	1
3	2
4	2
5	4

Your Turn

Calculate the mean score:

Score	Frequency
0	4
1	6
2	2
3	4
4	4
5	8

Fill in the Gaps

Data Set			
7	7	7	7
7			8
8	8	8	8
8			
9	9	9	9

Value	*Frequency*	*Value* × *Frequency*
7	6	42
8	9	72
9	5	45
Totals	20	159

Mean 159 ÷ 20 = 7.95

Data Set			
4	4	4	4

Value	*Frequency*	*Value* × *Frequency*
4	13	
5	2	
6	5	
Totals		

Mean ÷ =

Data Set			
2	2	2	2
2	3	3	3
3	3	3	3
4	4	4	4
4	4	4	4

Value	*Frequency*	*Value* × *Frequency*
2		
3		
4		
Totals	20	

Mean ÷ 20 =

Data Set			
12	12	12	12
12	12	12	12
12	12	12	12
12	14	14	14
14	14	14	14

Value	*Frequency*	*Value* × *Frequency*
12		
13		
14		
Totals		

Mean ÷ =

Fill in the Gaps

Data Set			
4	5	5	5
5	6	6	6
6	6	6	7
7	7	7	7
7	7	7	7

Frequency Table

Value	*Frequency*	*Value* × *Frequency*
4		
5		
6		
7		
Totals		

Mean ÷ =

Data Set			

Frequency Table

Value	*Frequency*	*Value* × *Frequency*
2.5	8	
2.6	3	
2.7		
2.8	5	
Totals	20	

Mean ÷ =

Data Set			

Frequency Table

Value	*Frequency*	*Value* × *Frequency*
8	5	
9	8	
10		
11	6	
Totals	24	

Mean ÷ =

Data Set			

Frequency Table

Value	*Frequency*	*Value* × *Frequency*
3	2	
4		
5		
6	12	
Totals	24	

Mean ÷ = 5.25

Worked Example

The table gives information about the numbers of badges gained by the girls in a Guide group.

a) Write down the mode.

b) Find the range.

c) Work out the median

d) Calculate the mean.

Number of badges	Frequency
0	2
1	8
2	4
3	3
4	5
5	3

Fill in the Gaps

Class		Total Frequency (class size)	Most common age (modal age)	Oldest student	Youngest student	Range of ages	Total of all their ages	Mean age	Median age
A	<table><tr><th>Age</th><th>Frequency</th></tr><tr><td>5</td><td>3</td></tr><tr><td>6</td><td>7</td></tr></table>								
B	<table><tr><th>Age</th><th>Frequency</th></tr><tr><td>7</td><td>3</td></tr><tr><td>8</td><td></td></tr><tr><td>9</td><td>9</td></tr></table>	20							
C	<table><tr><th>Age</th><th>Frequency</th></tr><tr><td>10</td><td></td></tr><tr><td>11</td><td>14</td></tr><tr><td>12</td><td></td></tr><tr><td>13</td><td></td></tr></table>	30	13		10	3			
D	<table><tr><th>Age</th><th>Frequency</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>		10 and 11	12		2	108	10.8	

Modal Class of Grouped Data

Worked Example

Determine the modal class interval:

Mass, x (kg)	Frequency
$0 < x \leq 10$	5
$10 < x \leq 20$	3
$20 < x \leq 40$	2
$40 < x \leq 46$	6
$46 < x \leq 50$	7

Your Turn

Determine the modal class interval:

Mass, x (kg)	Frequency
$0 < x \leq 10$	15
$10 < x \leq 20$	6
$20 < x \leq 40$	4
$40 < x \leq 46$	12
$46 < x \leq 50$	8

Range of Grouped Data

Worked Example

Determine the upper and lower bounds for the range:

Mass, x (kg)	Frequency
$0 < x \leq 10$	5
$10 < x \leq 20$	3
$20 < x \leq 40$	2
$40 < x \leq 46$	6
$46 < x \leq 50$	7

Your Turn

Determine the upper and lower bounds for the range:

Mass, x (kg)	Frequency
$10 < x \leq 20$	5
$20 < x \leq 30$	3
$30 < x \leq 50$	2
$50 < x \leq 56$	6
$56 < x \leq 60$	7

Median Class of Grouped Data

Worked Example

Determine the median class interval:

Mass, x (kg)	Frequency
$0 < x \leq 10$	5
$10 < x \leq 20$	3
$20 < x \leq 40$	2
$40 < x \leq 46$	6
$46 < x \leq 50$	7

Your Turn

Determine the median class interval:

Mass, x (kg)	Frequency
$0 < x \leq 10$	15
$10 < x \leq 20$	6
$20 < x \leq 40$	4
$40 < x \leq 46$	12
$46 < x \leq 50$	8

Median of Grouped Data

Worked Example

Jack collects the heights of 100 flowers and records the data in the table below.

Height (y cm)	Frequency
$40 < y \leq 50$	7
$50 < y \leq 60$	14
$60 < y \leq 70$	59
$70 < y \leq 80$	11
$80 < y \leq 90$	9

Use interpolation to estimate the median.
Give your answer correct to 1 decimal place.

Your Turn

James collects the heights of 80 flowers and records the data in the table below.

Height (x cm)	Frequency
$35 < x \leq 40$	4
$40 < x \leq 45$	9
$45 < x \leq 50$	26
$50 < x \leq 55$	13
$55 < x \leq 60$	8
$60 < x \leq 65$	20

Use interpolation to estimate the median.
Give your answer correct to 1 decimal place.

Quartiles of Grouped Data

Worked Example

Jack collects the heights of 100 flowers and records the data in the table below.

Height (y cm)	Frequency
$40 < y \leq 50$	7
$50 < y \leq 60$	14
$60 < y \leq 70$	59
$70 < y \leq 80$	11
$80 < y \leq 90$	9

Use interpolation to estimate the lower quartile and upper quartile.
Give your answer correct to 1 decimal place.

Your Turn

James collects the heights of 80 flowers and records the data in the table below.

Height (x cm)	Frequency
$35 < x \leq 40$	4
$40 < x \leq 45$	9
$45 < x \leq 50$	26
$50 < x \leq 55$	13
$55 < x \leq 60$	8
$60 < x \leq 65$	20

Use interpolation to estimate the lower quartile and upper quartile.
Give your answer correct to 1 decimal place.

Estimated Mean of Grouped Data

Worked Example

Calculate an estimate for the total mass:

Mass, x (kg)	Frequency
$0 < x \leq 8$	3
$8 < x \leq 16$	6
$16 < x \leq 24$	7
$24 < x \leq 32$	4

Your Turn

Calculate an estimate for the total mass:

Mass, x (kg)	Frequency
$0 < x \leq 8$	3
$8 < x \leq 16$	0
$16 < x \leq 24$	7
$24 < x \leq 32$	4

Worked Example

Calculate an estimate for the mean:

Mass, x (kg)	Frequency
$0 < x \leq 8$	3
$8 < x \leq 16$	6
$16 < x \leq 24$	7
$24 < x \leq 32$	4

Your Turn

Calculate an estimate for the mean:

Mass, x (kg)	Frequency
$0 < x \leq 8$	3
$8 < x \leq 16$	0
$16 < x \leq 24$	7
$24 < x \leq 32$	4

Fill in the Gaps

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$10 \leq x < 12$	6	11	66
$12 \leq x < 14$	9	13	117
$14 \leq x < 16$	5	15	75
Totals	20		258
Estimate of Mean	$258 \div 20 =$		

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$20 \leq x < 30$	9	25	225
$30 \leq x < 40$	7	35	
$40 \leq x < 50$	4	45	
Totals	20		
Estimate of Mean	$\div 20 =$		

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$20 \leq x < 24$	6	22	
$24 \leq x < 28$	10		
$28 \leq x < 32$	5		
$32 \leq x < 36$	4		
Totals	25		
Estimate of Mean	$\div =$		

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$5 \leq x < 10$	7		
$10 \leq x < 15$	7		
$15 \leq x < 20$	8		
$20 \leq x < 25$	3		
Totals	25		
Estimate of Mean	$\div =$		

Fill in the Gaps

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$100 \leq x < 120$	7		
$120 \leq x < 140$	12		
$140 \leq x < 160$			
$160 \leq x < 180$	2		
Totals	30		
Estimate of Mean	÷	=	

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$0 \leq x < 2$			3
$2 \leq x < 4$			9
$4 \leq x < 6$			40
$6 \leq x < 8$			42
Totals	20		
Estimate of Mean	÷ 20	=	

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$0 \leq x <$			40
$\leq x <$			240
$\leq x <$			275
$\leq x < 40$			
Totals			
Estimate of Mean	÷ 40	= 18.25	

Value	*Frequency*	*Midpoint*	*Midpoint* × *Freq*
$\leq x <$			
$\leq x <$			
$\leq x <$		55	1430
$\leq x <$		65	780
Totals			
Estimate of Mean	÷ 50	= 54.2	

In each table, values are grouped into classes of equal width.

Worked Example

Bob asked each of 40 friends how many minutes they took to get to work. The table shows some information about his results.

a) Write down the modal class.
b) Work out the upper and lower bounds for the range.
c) Work out the class in which the median lies.
d) Calculate an estimate for the median.
e) Calculate an estimate for the mean.

Time taken (m minutes)	Frequency
$0 < m \leq 10$	3
$10 < m \leq 20$	8
$20 < m \leq 30$	11
$30 < m \leq 40$	9
$40 < m \leq 50$	9

Extra Notes

2 Expanding Triple Brackets

Worked Example	Your Turn
Expand and simplify: $(x+2)(x-3)(x-4)$	Expand and simplify: $(x+4)(x-3)(x-2)$

Worked Example	Your Turn
Expand and simplify: $2x(7x-3)(x-4)$	Expand and simplify: $4x(7x-3)(x-2)$

Worked Example	Your Turn
Expand and simplify: $(5x + 2)(7x - 3)(x - 4)$	Expand and simplify: $(5x + 4)(7x - 3)(x - 2)$

Fill in the Gaps

Question	Multiply first two brackets			Simplify first two brackets	Multiply by third bracket				Simplified Answer
$(x+2)(x+1)(x+5)$	$\times$	x	$+2$	x^2+3x+2	$\times$	x^2	$+3x$	$+2$	$x^3+8x^2+17x+10$
	x	x^2	$+2x$		x	x^3	$+3x^2$	$+2x$	
	$+1$	$+x$	$+2$		$+5$	$+5x^2$	$+15x$	$+10$	
$(y+4)(y-2)(y+3)$	$\times$	y	$+4$		$\times$				
	y				y				
	-2				$+3$				
$(b-3)(b-5)(b-6)$	$\times$				$\times$				
$(2x+3)(x-4)(x+2)$	$\times$				$\times$				
$(2a-1)(3a+1)(a-2)$	$\times$				$\times$				

Worked Example	Your Turn
Expand and simplify: $(3x - 2)^3$	Expand and simplify: $(4x - 3)^3$

Worked Example	Your Turn
Expand and simplify: $(2x-3)^2(1-3x)$	Expand and simplify: $(3x-2)^2(1-2x)$

Fill in the Gaps

Question	Multiply first two brackets			Simplify first two brackets	Multiply by third bracket				Simplified Answer
$(x+3)(x-2)^2$	$\times$	x	$+3$	x^2+x-6	$\times$	x^2	$+x$	-6	
$=(x+3)(x-2)(x-2)$	x	x^2	$+3x$		x				
	-2	$-2x$	-6		-2				
$(y-5)(y+1)^2$	$\times$				$\times$				
$(t+6)(3t-2)^2$	$\times$				$\times$				
$(x+4)^3$	$\times$				$\times$				
$(2y-3)^3$	$\times$				$\times$				

Fill in the Gaps

Expanded Expression	Factorised Expression
$2x + 8$	$2(x + 4)$
	$3(x - 2)$
	$x(x + 7)$
$5x + 35$	
$8x - 12$	
	$2x(x - 5)$
$x^2 - x$	
	$5x(3 - x)$
$10x^2 + 2x$	
$6x + 9y$	
	$4xy(x + 2)$
$6xy - 4y^2$	
	$(x + 2)(x + 3)$
	$(x + 5)(x - 3)$
$x^2 + 8x + 15$	
$x^2 + 3x + 2$	

Expanded Expression	Factorised Expression
$x^2 - 7x + 10$	
	$(x - 6)(x + 4)$
	$(x + 7)(x - 7)$
$x^2 + x - 20$	
$x^2 - 25$	
	$(2x + 1)(x + 5)$
$x^2 - x - 6$	
$x^2 + 3x$	
	$(3x - 1)(x - 2)$
$4x^2 - 25$	
	$(x + 5)^2$
$7x^2 + 10x + 3$	
	$(3x - 1)^2$
$4x^2 + 4x + 1$	
$5x^2 - 14x - 3$	
	$(x - 2)^3$

Worked Example	Your Turn
Expand and simplify: $(3x-2)^3-(6x-5)^2$	Expand and simplify: $(4x-3)^3-(5x-6)^2$

Extra Notes

3 Solving Quadratics

Multiplication by Zero

$(a-3)\times 2=0$ $a=$ _____

$(a-7)\times a=0$ $a=$ _____

$a\times a=0$ $a=$ _____

$(a+5)(a-3)=0$ $a=$ _____

$a^2+6a+8=0$ $a=$ _____

$a^2+8a+16=0$ $a=$ _____

Worked Example	Your Turn
What values of x satisfy the equation $x(x-9)=0$?	What values of x satisfy the equation $(x+6)x=0$?

Worked Example	Your Turn
What values of x satisfy the equation $(x - 9)(x + 5) = 0$?	What values of x satisfy the equation $(x + 6)(x - 5) = 0$?

Worked Example	Your Turn
Solve the equation $(2x - 3)(3x + 1) = 0$	Solve the equation $(3x + 2)(2x - 1) = 0$

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Worked Example	Your Turn
Solve the equation $x^2 + 2x - 8 = 0$	Solve the equation $x^2 + 2x - 15 = 0$

Dr Frost 367b

Worked Example	Your Turn
Solve the equation $x^2 - 49 = 0$	Solve the equation $x^2 - 64 = 0$

Worked Example	Your Turn
Solve the equation $3x^2 + 2x = 0$	Solve the equation $2x^2 - 3x = 0$

Worked Example	Your Turn
Solve the equation $x^2 - 4x + 4 = 0$	Solve the equation $x^2 + 14x + 49 = 0$

Fill in the Gaps

	Quadratic	Factorised	Equations	Solutions
1	$x^2 + 6x + 5 = 0$	$(x + 5)(x + 1) = 0$	$x + 5 = 0$ $x + 1 = 0$	
2	$x^2 + 7x + 10 = 0$	$(x + 5)(x + 2) = 0$	$x + 5 = 0$ $x + \quad = 0$	$x = -5$ $x =$
3	$x^2 + 8x + 15 = 0$	$(x + 5)(x + 3) = 0$		
4	$x^2 + 7x + 12 = 0$	$(x + 4)(x + \quad) = 0$		
5	$x^2 + 8x + 16 = 0$	$(x + 4)(x + \quad) = 0$		
6	$x^2 + 10x + 24 = 0$			
7	$x^2 + 14x + 24 = 0$			
8	$x^2 + 14x + 40 = 0$			
9		$(x + \quad)(x + \quad) = 0$	$x + 8 = 0$ $x + 5 = 0$	
10				$x = -40$ $x = -1$
11	$x^2 + 4x - 5 = 0$	$(x + 5)(x - 1) = 0$	$x + 5 = 0$ $x - 1 = 0$	
12	$x^2 - 4x - 5 = 0$	$(x - 5)(x + 1) = 0$	$x - 5 = 0$ $x + 1 = 0$	
13	$x^2 + 4x - 12 = 0$	$(x + 6)(x - 2) = 0$	$x + 6 = 0$ $x - 2 = 0$	
14	$x^2 + x - 12 = 0$	$(x + 4)(x - 3) = 0$		
15	$x^2 - 11x - 12 = 0$	$(x - 12)(x \quad) = 0$		
16	$x^2 + 2x - 8 = 0$	$(x + 4)(x \quad) = 0$		
17	$x^2 - 2x - 8 = 0$			
18	$x^2 + 7x - 8 = 0$			
19	$x^2 - 7x - 8 = 0$			
20		$(x - 5)(x - 1) = 0$		
21				$x = 5$ $x = 2$
22				$x = 5$ $x = 5$
23				$x = -5$ $x = 5$

Fill in the Gaps

Quadratic Equation	Factorised Equation	1st Equation	2nd Equation	1st Solution	2nd Solution
$x^2 + 8x + 15 = 0$	$(x + 5)(x + 3) = 0$	$x + 5 = 0$	$x + 3 = 0$	$x = -5$	$x = -3$
$x^2 - 8x - 20 = 0$					
$x^2 - x - 20 = 0$					
$x^2 - x - 6 = 0$					
$x^2 - 5x + 6 = 0$					
$x^2 - 5x + 4 = 0$					
$x^2 - 4x + 4 = 0$					
	$(x - 7)(x + 3) = 0$				
		$x - 8 = 0$	$x + 5 = 0$		
		$x + 6 = 0$			$x = -7$
				$x = 3$	$x = -5$

Worked Example	Your Turn
Solve the equation $5x^2 + 13x - 6 = 0$	Solve the equation $5x^2 + 7x - 6 = 0$

Worked Example	Your Turn
Solve the equation $4x^2 - 9 = 0$	Solve the equation $16x^2 - 81 = 0$

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Worked Example	Your Turn
Solve the equation $x^2 - x = 12$	Solve the equation $x^2 = 2x + 3$

Dr Frost 367c and 367e

Worked Example	Your Turn
Solve the equation $12x^2 + 10x - 12 = 0$	Solve the equation $18x^2 - 15x - 18 = 0$

Worked Example	Your Turn
Solve the equation $x(x-2)=15$	Solve the equation $(x-3)(x+2)=6$

Worked Example	Your Turn
a) A quadratic equation has solutions of $x = -9$ and $x = 6$ Find the original equation, giving your answer in the form $x^2 + bx + c = 0$, where b and c are whole numbers.	a) A quadratic equation has solutions of $x = -8$ and $x = 2$ Find the original equation, giving your answer in the form $x^2 + bx + c = 0$, where b and c are whole numbers.
b) A quadratic equation has solutions of $x = -\frac{3}{2}$ and $x = \frac{1}{4}$ Find the original equation, giving your answer in the form $8x^2 + bx + c = 0$	b) A quadratic equation has solutions of $x = -\frac{3}{5}$ and $x = \frac{1}{2}$ Find the original equation, giving your answer in the form $10x^2 + bx + c = 0$

Dr Frost 367h and 367i

Worked Example	Your Turn
Solve $5x - \frac{3}{x} = 14$	Solve $3x + \frac{14}{x} = 13$

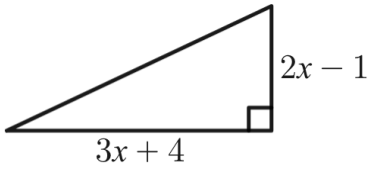
Dr Frost 462a

Worked Example	Your Turn
Solve the following equation: $x + 2 = -\frac{4}{3x - 7}$	Solve the following equation: $-\frac{7}{3x + 4} = x - 6$

Worked Example	Your Turn
The width of a rectangular field is 3 m shorter than its length. The area of the field is 126 m^2. Show that $x^2 + bx + c = 0$ where x is the length of the field and b and c are constants to be found.	The length of a rectangular swimming pool is 6 m longer than its width. The area of the swimming pool is 144 m^2. Show that $y^2 + by + c = 0$ where y is the width of the swimming pool and b and c are constants to be found.

Worked Example

The area of the triangle shown below is 15 cm^2

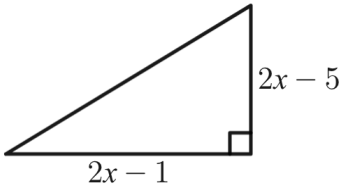


All lengths are in centimetres.

Show that $6x^2 + bx + c = 0$, where b and c are integers to be found.

Your Turn

The area of the triangle shown below is 30 cm^2

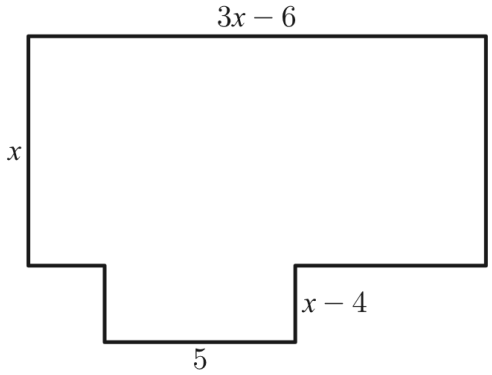


All lengths are in centimetres.

Show that $4x^2 + bx + c = 0$, where b and c are integers to be found.

Worked Example

The area of the triangle shown below is 82 cm²

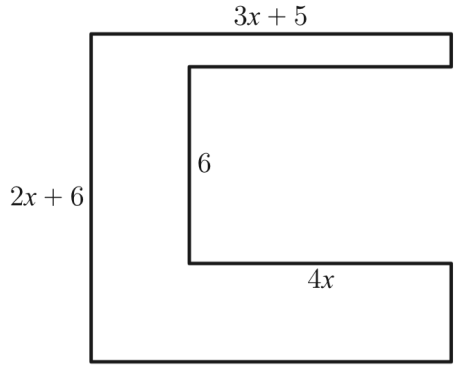


All lengths are in centimetres.

Show that $3x^2 + bx + c = 0$, where b and c are integers to be found.

Your Turn

The area of the triangle shown below is 62 cm²

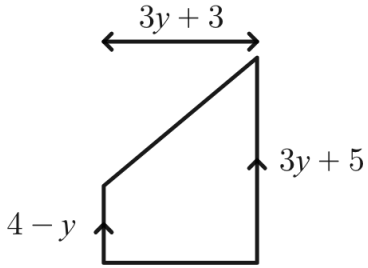


All lengths are in centimetres.

Show that $3x^2 + bx + c = 0$, where b and c are integers to be found.

Worked Example

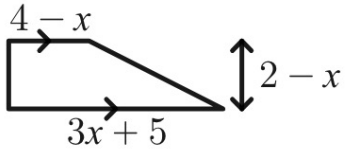
The area of the trapezium is 219 mm².
All measurements are in mm.



Show that $6y^2 + by + c = 0$, where b and c are integers to be determined.

Your Turn

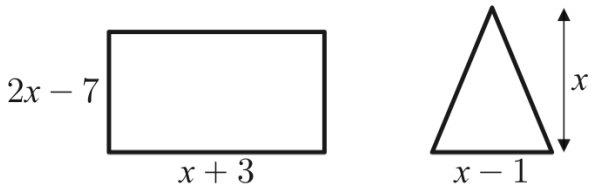
The area of the trapezium is 216 mm².
All measurements are in mm.



Show that $2x^2 + bx + c = 0$, where b and c are integers to be determined.

Worked Example

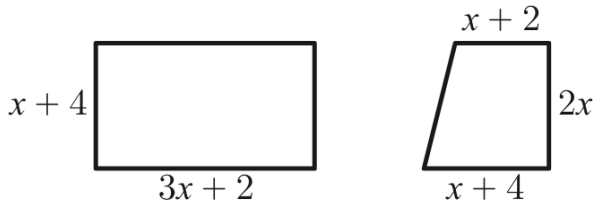
In the diagram below, the area of the rectangle is three times the area of the triangle.



All measurements are in centimetres.
Determine the value of x

Your Turn

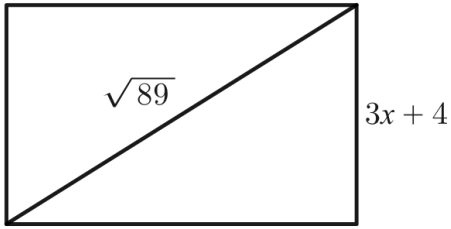
In the diagram below, the area of the rectangle is twice the area of the trapezium.



All measurements are in centimetres.
Determine the value of x

Worked Example

The rectangle in the diagram below has a perimeter of 26 cm

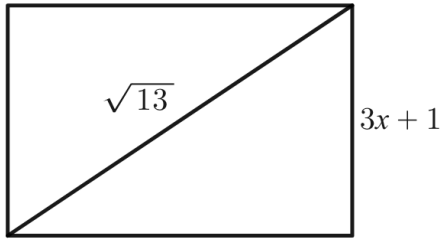


The width of the rectangle is $(3x + 4)$ cm
The length of the diagonal of the rectangle is $\sqrt{89}$ cm

Determine the possible values of x

Your Turn

The rectangle in the diagram below has a perimeter of 10 cm

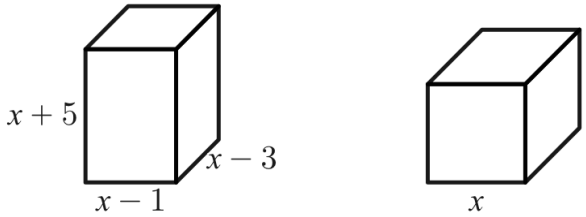


The width of the rectangle is $(3x + 1)$ cm
The length of the diagonal of the rectangle is $\sqrt{13}$ cm

Determine the possible values of x

Worked Example

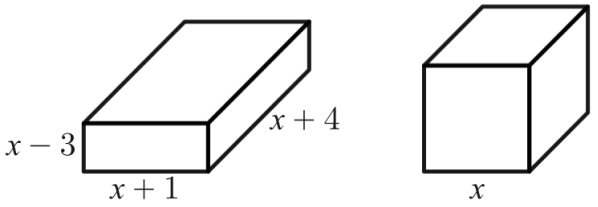
The diagram below shows a cuboid and a cube.
The volume of the cuboid is 27 cm^3 less than the volume of the cube.



All measurements are in centimetres.
Determine the value of x

Your Turn

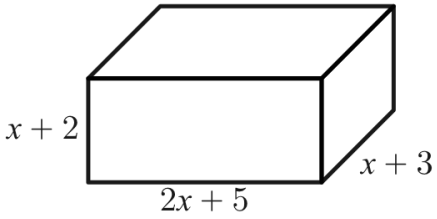
The diagram below shows a cuboid and a cube.
The volume of the cuboid is 12 cm^3 less than the volume of the cube.



All measurements are in centimetres.
Determine the value of x

Worked Example

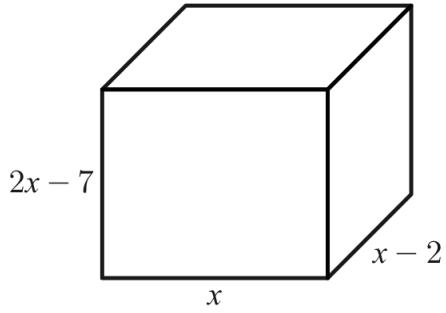
The cuboid shown below has a total surface area of 202 cm^2



All measurements are in centimetres.
Determine the value of x

Your Turn

The cuboid shown below has a total surface area of 148 cm^2



All measurements are in centimetres.
Determine the value of x

Worked Example

The prism shown below has a volume of 39 cm³

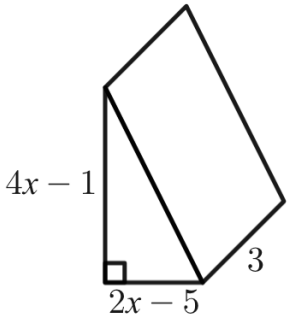


Diagram NOT drawn to scale.

All measurements are given in centimetres.
Determine the value of x

Your Turn

The prism shown below has a volume of 15 cm³

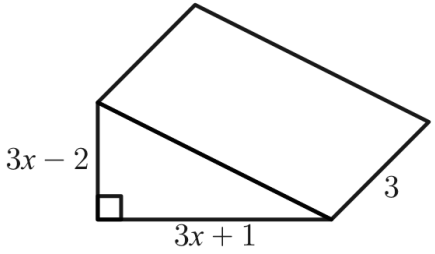


Diagram NOT drawn to scale.

All measurements are given in centimetres.
Determine the value of x

Worked Example	Your Turn
Solve: a) $x^2 - 28 = 53$ b) $5\sqrt[3]{x} = 100$	Solve: a) $\frac{\sqrt{x}}{3} = 4$ b) $24 + x^3 = 88$

Dr Frost 200g and 200h

Worked Example	Your Turn
Solve: a) $\sqrt{19+5x^2}=8$ b) $\sqrt{13+\sqrt{4y+1}}=4$	Solve: a) $\sqrt{53-\sqrt{3z+1}}=7$ b) $\sqrt{37+3x^2}=8$

Quadratic Formula

Worked Example	Your Turn
Write down the values of a, b and c in: a) $5x^2 + 2x - 3 = 0$ b) $x^2 + 2x - 3 = 0$ c) $x^2 + 2x = 4x - 3$	Write down the values of a, b and c in: a) $5x^2 - 2x + 3 = 0$ b) $x^2 - 2x + 3 = 0$ c) $x^2 - 2x = -4x + 3$

Intelligent Practice

Questions	a	b	c
$3x^2 + 5x + 1 = 0$			
$0 = 3x^2 + 5x + 1$			
$0 = 3x^2 + 5x + 2$			
$3x^2 + 4x + 2 = 0$			
$0 = 3x^2 + 4x - 2$			
$3x^2 - 4x + 2 = 0$			
$x^2 - 4x + 2 = 0$			
$x^2 + 2 - 4x = 0$			
$1 + 2x - 4x^2 = 0$			
$1 + 2x = 4x^2$			

Intelligent Practice

Questions	a	b	c
$2x = 4x^2 + 1$			
$1 = 4x^2 + 2$			
$4x^2 + 2x = 0$			
$4x^2 + 2 = 0$			
$2(2x^2 + 1) = 0$			
$-2(2x^2 + 1) = 0$			
$-2(2x^2 + 1) = 2x$			
$-2(2x^2 + 1) = 2x + 2$			
$-2(2x^2 + 1) = x^2 + 2x + 2$			
$-2(2x^2 + x + 1) = x^2 + 2x + 2$			

Discriminant

Worked Example	Your Turn
Calculate the discriminant of $5x^2 + 6x - 7$	Calculate the discriminant of $-6x^2 + 7x + 8$

Worked Example	Your Turn
By calculating the discriminant, work out the number of real solutions to the equation $4x^2 - 2x - 9 = 0$	By calculating the discriminant, work out the number of real solutions to the equation $-4x^2 - 7x - 4 = 0$

Worked Example	Your Turn
Solve the following quadratic equation, leaving your answer in exact form: $x^2 - 9x - 2 = 0$	Solve the following quadratic equation, leaving your answer in exact form: $x^2 - 10x + 3 = 0$

Worked Example	Your Turn
Solve the following quadratic equation, giving your answer accurate to 2 decimal places: $3x^2 + 7x - 2 = 0$	Solve the following quadratic equation, giving your answer accurate to 2 decimal places: $3x^2 - 9x + 2 = 0$

Worked Example	Your Turn
Solve the equation $4x^2 = 7x + 1$ giving your answers correct to two decimal places.	Solve the equation $7x^2 = 4x + 1$ giving your answers correct to two decimal places.

Worked Example	Your Turn
Catherine is using the quadratic formula to solve a quadratic equation. She substitutes values into the formula and correctly gets $x = \frac{4 \pm \sqrt{16+60}}{6}$ The original equation was in the form $ax^2 + bx + c = 0$, where a, b, and c are integers which cannot be simplified. Determine the values of a, b, and c.	Brigid is using the quadratic formula to solve a quadratic equation. She substitutes values into the formula and correctly gets $x = \frac{-3 \pm \sqrt{9+64}}{4}$ The original equation was in the form $ax^2 + bx + c = 0$, where a, b, and c are integers which cannot be simplified. Determine the values of a, b, and c.

Fill in the Gaps

Quadratic Equation	a, b and c	$b^2 - 4ac$	$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$	$x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$	Solutions to 3sf
$x^2 + 5x + 1 = 0$	$a = 1, b = 5, c = 1$	$5^2 - 4 \times 1 \times 1 = 21$	$x = \frac{-5 + \sqrt{21}}{2}$	$x = \frac{-5 - \sqrt{21}}{2}$	
$2x^2 + 5x + 1 = 0$	$a = 2, b = 5, c = 1$	$5^2 - 4 \times 2 \times 1 = 17$			
$2x^2 - 5x + 1 = 0$	$a = 2, b = -5, c = 1$	$(-5)^2 - 4 \times 2 \times 1 = 17$	$x = \frac{5 + \sqrt{17}}{4}$		
$x^2 - 7x + 3 = 0$					
$2x^2 - 7x + 3 = 0$					
$5x^2 + x - 2 = 0$					
	$a = 3, b = 5, c = 2$				
			$x = \frac{-9 + \sqrt{89}}{4}$	$x = \frac{-9 - \sqrt{89}}{4}$	

Fill in the Gaps

Using the Quadratic Formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1) Identify a, b & c and substitute into the quadratic formula.
2) **Remember!** The square root of the discriminant can be positive or negative – You must complete the formula for both!
3) Give your answers to 2 decimal places

$x^2 + 5x + 3 = 0$	$a = 1$ $b = 5$ $c = 3$	$x = \dfrac{-(\quad) \pm \sqrt{(\quad)^2 - 4(\quad)(\quad)}}{2(\quad)}$	$x = \dfrac{-(\quad) \pm \sqrt{(\qquad)}}{(\qquad)}$	$x = \dfrac{-(\quad) - (\quad)}{(\quad)}$ $x = \dfrac{-(\quad) + (\quad)}{(\quad)}$	$x = -0.70$ or $x =$
$x^2 + 6x - 2 = 0$	$a = 1$ $b =$ $c =$	$x = \dfrac{-(\quad) \pm \sqrt{(\quad)^2 - 4(\quad)(\quad)}}{2(\quad)}$	$x = \dfrac{-(\quad) \pm \sqrt{(\qquad)}}{(\qquad)}$	$x = \dfrac{-(\quad) - (\quad)}{(\quad)}$ $x = \dfrac{-(\quad) + (\quad)}{(\quad)}$	$x = 0.32$ or $x =$
$2x^2 + 8x + 3 = 0$	$a =$ $b =$ $c =$	$x = \dfrac{-(\quad) \pm \sqrt{(\quad)^2 - 4(\quad)(\quad)}}{2(\quad)}$	$x = \dfrac{-(\quad) \pm \sqrt{(\qquad)}}{(\qquad)}$		
$4x^2 + 3x - 6 = 0$		$x = \dfrac{-(\quad) \pm \sqrt{(\quad)^2 - 4(\quad)(\quad)}}{2(\quad)}$			
$5x^2 - 4x - 8 = 0$					

2) Use the quadratic formula to solve these equations. Give your answers to 2 decimal places.

a) $2x^2 + 9x = -3$

b) $4x^2 - 3 = 7x$

c) $5x = -8 + 5x^2$

Fill in the Gaps

1 Complete the table below.

Q	Equation	a	b	c	Substitution	Simplification	Exact Answer	Answers to 3sf
Ex	$x^2 + 5x + 1 = 0$	1	5	1	$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(1)}}{2(1)}$	$x = \frac{-5 \pm \sqrt{25-4}}{2}$	$x = \frac{-5 \pm \sqrt{21}}{2}$	**x = -4.79 & x = -0.209**
1	$x^2 + 6x + 1 = 0$							
2	$x^2 + 6x + 2 = 0$							
3	$x^2 + 7x + 2 = 0$							
4	$x^2 + 7x - 2 = 0$							
5	$x^2 - 7x - 2 = 0$							
6	$-x^2 - 7x - 2 = 0$							
7	$-x^2 - 7x + 2 = 0$							
8	$2 - 7x - x^2 = 0$							

Fill in the Gaps

9		1	7	3				
10		1	7	4				
11		1	-7	4				
12					$x=\frac{-(-7)\pm\sqrt{(-7)^2-4(-1)(4)}}{2(-1)}$			
13						$x=\frac{-(-8)\pm\sqrt{64+16}}{2(-1)}$		
14		-1					$x=\frac{-8\pm\sqrt{84}}{-2}$	
15	$\frac{1}{2}x^2+4x+5=0$	$\frac{1}{2}$						
16	$\frac{1}{2}(x^2+4x+5)=0$							
17	$\frac{1}{3}(x^2+4x+5)=0$							
18	$\frac{2x^2+4x+5}{3}=0$							

Fill in the Gaps

2 Complete the table below.

Q	Equation	a	b	c	Substitution	Simplification	Exact Answer	Answers to 3sf
Ex	$2x^2 + 5x + 1 = 0$	2	5	1	$x = \frac{-5 \pm \sqrt{5^2 - 4(2)(1)}}{2(2)}$	$x = \frac{-5 \pm \sqrt{25-8}}{4}$	$x = \frac{-5 \pm \sqrt{17}}{4}$	**x = -2.28 & x = -0.219**
1	$2x^2 + 6x + 1 = 0$							
2	$2x^2 + 6x + 2 = 0$							
3	$2x^2 + 6x - 2 = 0$							
4	$2x^2 - 6x + 2 = 0$							
5	$2x^2 - 6x - 2 = 0$							
6	$3x^2 - 6x - 2 = 0$							
7	$4x^2 - 6x - 2 = 0$							
8	$4x^2 - 6x + 2 = 0$							

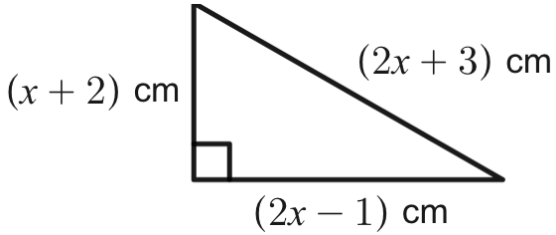
Fill in the Gaps

9	$2-6x+4x^2=0$							
10	$2-6x-4x^2=0$							
11	$1-3x-2x^2=0$							
12	$\frac{1}{2}-\frac{3}{2}x-x^2=0$							
13	$\frac{1}{6}-\frac{1}{2}x-\frac{1}{3}x^2=0$							
14	$\frac{1}{3}x^2+\frac{1}{2}x-\frac{1}{6}=0$							
15	$\frac{1}{3}x^2+\frac{1}{2}x-\frac{1}{6}=1$							
16	$\frac{1}{3}x^2+\frac{1}{2}x-\frac{1}{6}=x$							
17	$\frac{1}{3}x^2+\frac{1}{2}x-\frac{1}{6}=x^2$							
18	$\frac{1}{3}x^2+\frac{1}{2}x-\frac{1}{6}=-x^2$							

Worked Example	Your Turn
Solve the following equation: $\frac{x+5}{x+6} = -\frac{6}{5x-2}$ Give your answer in exact form.	Solve the following equation: $-\frac{3x}{3x+5} = \frac{x-3}{x+2}$ Give your answer in exact form.

Worked Example

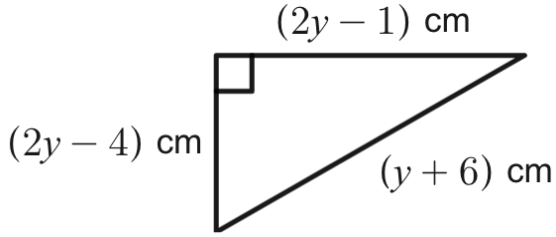
A right-angled triangle has sides $(x + 2)$ cm, $(2x - 1)$ cm and $(2x + 3)$ cm.



Find the value of x.
Give your answer correct to 2 decimal places.

Your Turn

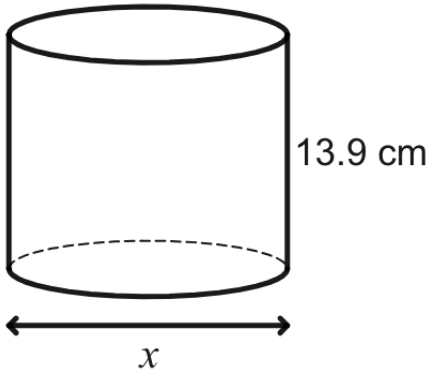
A right-angled triangle has sides $(2y - 4)$ cm, $(2y - 1)$ cm and $(y + 6)$ cm.



Find the value of y.
Give your answer correct to 2 decimal places.

Worked Example

The surface area of the cylinder is 1158 cm^2.

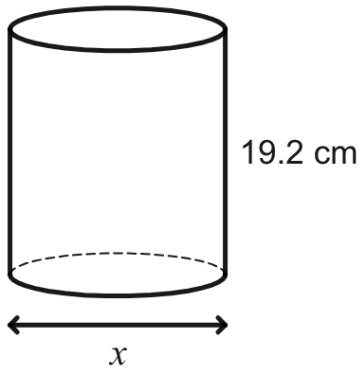


Find the value of x.

Give your answer correct to 1 decimal place.

Your Turn

The surface area of the cylinder is 1457 cm^2.



Find the value of x.

Give your answer correct to 1 decimal place.

Extra Notes