Year 7

2023 **Mathematics** **2024**

Unit 3 Booklet

HGS Maths

Tasks

Dr Frost Course

Name: _____

Class: _____

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(Vinculum)

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Denominator

Worked Example	Your Turn
Multiply these fractions so they have a denominator of 8: a) $\frac{1}{2}$ b) $\frac{3}{4}$	Multiply these fractions so they have a denominator of 12: a) $\frac{1}{2}$ b) $\frac{3}{4}$

1.2 Simplifying Fractions

A fraction is in its simplest form if 1 is the only common factor of its numerator and denominator.

You may have been told that you cannot write decimals inside a fraction.

This is almost true. We can write decimals in a fraction, but that fraction would not be easy to think about, or to picture, so it's not helpful.

If we see a fraction with decimals in it, that fraction is not in its simplest form.

Worked Example	Your Turn
Simplify: a) $\dfrac{6}{20}$ b) $\dfrac{12}{20}$	Simplify: a) $\dfrac{6}{18}$ b) $\dfrac{12}{18}$

Worked Example	Your Turn
Simplify these fractions:	Simplify these fractions:

Simplify these fractions:

a) $\dfrac{0.4}{0.7}$

b) $\dfrac{0.4}{1.2}$

c) $\dfrac{0.44}{1}$

Simplify these fractions:

a) $\dfrac{0.5}{0.6}$

b) $\dfrac{0.6}{2.4}$

c) $\dfrac{0.36}{2}$

Worked Example	Your Turn
Express 50p as a fraction of £4. Give your answer in its simplest form.	Express 20p as a fraction of £10. Give your answer in its simplest form.

Frayer Model – Improper Fraction

Definition

Characteristics

Examples

Non-Examples

Frayer Model – Mixed Number

Definition	Characteristics

Examples	Non-Examples

Worked Example	Your Turn
Convert $\frac{6}{5}$ into a mixed number	Convert $\frac{13}{5}$ into a mixed number

Worked Example	Your Turn
Convert $2\frac{1}{3}$ into an improper fraction	Convert $4\frac{1}{3}$ into an improper fraction

Fill in the Gaps

① Complete the table below, to show links between division and fractions.

Division	Written Calculation	Mixed Numbers	Improper
$13 \div 5$	$\begin{array}{r} 2\ r\ 3 \\ 5\,\overline{)\,13} \end{array}$	$2\frac{3}{5}$	$\frac{13}{5}$
$11 \div 4$			
$12 \div 7$			
	$\begin{array}{r} 3\ r\ 3 \\ 5\,\overline{)\,18} \end{array}$		
	$\begin{array}{r} 8\ r\ 1 \\ 2\,\overline{)\,17} \end{array}$		
		$4\frac{1}{5}$	
		$3\frac{2}{3}$	
			$\frac{22}{6}$
			$\frac{39}{7}$

1.4 Adding and Subtracting Fractions

Fractions with the same denominators can be added (or subtracted) by adding (or subtracting) the numerators.

If two fractions do not have the same denominator, then find a common denominator by making equivalent fractions.

Which Denominator?

$\dfrac{2}{3} - \dfrac{1}{3} = \underline{} - \underline{}$

$\dfrac{2}{3} - \dfrac{1}{6} = \underline{} - \underline{}$

$\dfrac{2}{3} + \dfrac{1}{6} = \underline{} - \underline{}$

$\dfrac{2}{9} + \dfrac{1}{6} = \underline{} - \underline{}$

$\dfrac{2}{9} + \dfrac{1}{5} = \underline{} - \underline{}$

Worked Example	Your Turn
Calculate:	Calculate:
a) $\frac{2}{5} + \frac{1}{3}$	a) $\frac{2}{3} + \frac{1}{5}$
b) $\frac{2}{5} - \frac{1}{3}$	b) $\frac{2}{3} - \frac{1}{5}$

Fill in the Gaps

Question	With a Common Denominator	Unsimplified Answer	Simplified Answer (where possible)
$\dfrac{1}{3} + \dfrac{1}{6}$	$\dfrac{2}{6} + \dfrac{1}{6}$	$\dfrac{3}{6}$	$\dfrac{\Box}{\Box}$
$\dfrac{1}{4} + \dfrac{2}{3}$	$\dfrac{3}{12} + \dfrac{\Box}{12}$	$\dfrac{\Box}{12}$	$\dfrac{\Box}{12}$
$\dfrac{2}{5} + \dfrac{1}{4}$	$\dfrac{\Box}{20} + \dfrac{\Box}{20}$	$\dfrac{\Box}{20}$	$\dfrac{\Box}{20}$
$\dfrac{5}{6} - \dfrac{1}{2}$	$\dfrac{\Box}{6} - \dfrac{\Box}{6}$	$\dfrac{\Box}{6}$	$\dfrac{\Box}{\Box}$
$\dfrac{7}{8} - \dfrac{2}{3}$	$\dfrac{21}{\Box} - \dfrac{16}{\Box}$	$\dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box}$
$\dfrac{7}{9} - \dfrac{3}{4}$	$\dfrac{\Box}{\Box} - \dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box}$
$\dfrac{\Box}{\Box} + \dfrac{\Box}{\Box}$	$\dfrac{\Box}{35} + \dfrac{14}{35}$	$\dfrac{24}{35}$	$\dfrac{24}{35}$
$\dfrac{\Box}{\Box} - \dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box} - \dfrac{5}{\Box}$	$\dfrac{6}{20}$	$\dfrac{\Box}{\Box}$
$\dfrac{\Box}{\Box} + \dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box} + \dfrac{7}{24}$	$\dfrac{\Box}{\Box}$	$\dfrac{2}{3}$
$\dfrac{13}{15} - \dfrac{\Box}{\Box}$	$\dfrac{26}{\Box} - \dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box}$	$\dfrac{7}{10}$
$\dfrac{3}{10} + \dfrac{\Box}{\Box} + \dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box} + \dfrac{5}{20} + \dfrac{\Box}{\Box}$	$\dfrac{\Box}{\Box}$	$\dfrac{9}{10}$
$\dfrac{\Box}{\Box} + \dfrac{\Box}{\Box} - \dfrac{\Box}{\Box}$	$\dfrac{5}{\Box} + \dfrac{\Box}{\Box} - \dfrac{8}{\Box}$	$\dfrac{\Box}{36}$	$\dfrac{2}{3}$

Worked Example	Your Turn
Calculate:	Calculate:
a) $2\frac{1}{2} + 3\frac{2}{5}$	a) $2\frac{1}{3} + 3\frac{2}{5}$
b) $2\frac{1}{2} - 1\frac{2}{5}$	b) $2\frac{1}{3} - 1\frac{2}{5}$

Question	Write as Improper Fractions	Convert to Common Denominator	Answer as Improper Fraction	Answer as Mixed Number
$1\frac{1}{3}+2\frac{1}{2}$	$\frac{4}{3}+\frac{5}{2}$	$\frac{8}{6}+\frac{15}{6}$	$\frac{23}{6}$	
$3\frac{2}{3}+1\frac{1}{4}$	$\frac{11}{3}+\frac{5}{4}$	$\frac{44}{12}+\frac{15}{12}$		
$4\frac{1}{2}-3\frac{2}{5}$	$\frac{9}{2}-\frac{17}{5}$	$\frac{\square}{10}-\frac{\square}{10}$		
$2\frac{3}{4}+1\frac{5}{6}$	$\frac{11}{4}+\frac{11}{6}$			
$5\frac{1}{3}-3\frac{2}{5}$				
$4\frac{3}{4}-2\frac{5}{7}$				
$2\frac{8}{9}+3\frac{3}{5}$				
$2\frac{13}{20}-\frac{7}{8}$				
	$\frac{7}{4}+\frac{12}{5}$			
	$\frac{\square}{9}-\frac{\square}{4}$	$\frac{100}{36}-\frac{45}{36}$		
	$\frac{3}{2}+\frac{\square}{\square}$		$\frac{29}{10}$	
$\frac{\square}{\square}-2\frac{1}{6}$				$3\frac{7}{30}$

1.5 Multiplying Fractions

When multiplying fractions, multiply the numerators together and multiply the denominators together, then simplify, or it is sometimes easier to simplify first.

Worked Example	Your Turn
Calculate: $$\frac{2}{3} \times \frac{1}{6}$$	Calculate: $$\frac{2}{3} \times \frac{5}{6}$$

Worked Example	Your Turn
Calculate $2 \times \dfrac{1}{5}$	Calculate $\dfrac{3}{5} \times 2$

Worked Example	Your Turn
Calculate: $$1\frac{1}{3} \times \frac{2}{5}$$	Calculate: $$\frac{1}{3} \times 1\frac{2}{5}$$

Fill in the Gaps

Question	Write as Improper Fractions	Multiply Numerators/ Denominators	Simplify (where possible)	Answer as Mixed Number
$1\frac{2}{3} \times 1\frac{1}{2}$	$\frac{5}{3} \times \frac{3}{2}$	$\frac{15}{6}$	$\frac{5}{2}$	
$2\frac{2}{5} \times 1\frac{1}{3}$	$\frac{12}{5} \times \frac{4}{3}$	$\frac{48}{15}$		
$3\frac{1}{2} \times 3\frac{1}{3}$	$\frac{7}{2} \times \frac{10}{3}$			
$1\frac{3}{4} \times 2\frac{5}{7}$				
$2\frac{4}{5} \times \frac{6}{7}$				
$2\frac{3}{10} \times 2\frac{2}{9}$				
$5\frac{2}{3} \times 1\frac{3}{4}$				
$3\frac{7}{10} \times 1\frac{3}{7}$				
$5\frac{1}{2} \times 2\frac{3}{4}$				
	$\frac{9}{5} \times \frac{10}{3}$			
	$\frac{\square}{\square} \times \frac{5}{3}$	$\frac{75}{12}$		
$\square\frac{\square}{\square} \times 2\frac{2}{5}$		$\frac{132}{20}$		

Worked Example	Your Turn
Calculate: a) $\dfrac{2}{5} \times \dfrac{25}{18}$ b) $4\dfrac{1}{5} \times 5\dfrac{5}{7}$	Calculate: a) $\dfrac{2}{5} \times \dfrac{25}{16}$ b) $4\dfrac{1}{5} \times 6\dfrac{3}{7}$

Worked Example	Your Turn
Calculate:	Calculate:
a) $\left(\dfrac{5}{8}\right)^2$	a) $\left(\dfrac{3}{7}\right)^2$
b) $\sqrt{\dfrac{16}{81}}$	b) $\sqrt{\dfrac{49}{81}}$

1.7 Reciprocals

The reciprocal of a number is the number you would have to multiply it by to get the answer 1.

Worked Example	Your Turn
Write the reciprocals of: a) 6 b) $\dfrac{1}{6}$ c) $\dfrac{5}{6}$	Write the reciprocals of: a) 7 b) $\dfrac{1}{7}$ c) $\dfrac{2}{7}$

1.8 Dividing Fractions

Worked Example	Your Turn
Calculate: $$\frac{1}{5} \div \frac{1}{3}$$	Calculate: $$\frac{1}{5} \div \frac{2}{3}$$

Worked Example	Your Turn
Calculate:	Calculate:
a) $\frac{1}{5} \div 2$	a) $\frac{2}{5} \div 2$
b) $2 \div \frac{1}{5}$	b) $2 \div \frac{2}{5}$

Division	Equivalent Multiplication	Unsimplified Answer	Simplified Answer (where possible)
$\frac{2}{3} \div 6$	$\frac{2}{3} \times \frac{1}{6}$	$\frac{2}{18}$	$\frac{\square}{\square}$
$\frac{2}{5} \div 4$	$\frac{2}{5} \times \frac{1}{4}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{5}{8} \div 10$	$\frac{\square}{\square} \times \frac{\square}{\square}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{7}{10} \div \frac{3}{4}$	$\frac{7}{10} \times \frac{4}{3}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{6}{11} \div \frac{2}{3}$	$\frac{\square}{\square} \times \frac{\square}{\square}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{1}{10} \div \frac{4}{5}$	$\frac{\square}{\square} \times \frac{\square}{\square}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{7}{10} \div \frac{3}{4}$	$\frac{\square}{\square} \times \frac{\square}{\square}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{\square}{\square} \div \frac{\square}{\square}$	$\frac{2}{9} \times \frac{6}{5}$	$\frac{\square}{\square}$	$\frac{\square}{\square}$
$\frac{\square}{\square} \div \frac{\square}{\square}$	$\frac{3}{8} \times \frac{\square}{\square}$	$\frac{12}{24}$	$\frac{\square}{\square}$
$\frac{\square}{\square} \div \frac{2}{5}$	$\frac{\square}{\square} \times \frac{\square}{\square}$	$\frac{15}{20}$	$\frac{\square}{\square}$
$\frac{\square}{\square} \div \frac{\square}{\square}$	$\frac{5}{12} \times \frac{\square}{\square}$	$\frac{10}{12}$	$\frac{\square}{\square}$
$\frac{\square}{\square} \div \square$	$\frac{\square}{\square} \times \frac{1}{3}$	$\frac{\square}{\square}$	$\frac{3}{10}$

Worked Example	Your Turn
Calculate: $2\dfrac{2}{3} \div \dfrac{1}{5}$	Calculate: $2\dfrac{2}{3} \div \dfrac{2}{5}$

Fill in the Gaps

Question	Write as Improper Fractions	Write as a Multiplication	Multiply and Simplify (where possible)	Answer as Mixed Number
$2\frac{2}{3} \div 1\frac{1}{2}$	$\frac{8}{3} \div \frac{3}{2}$	$\frac{8}{3} \times \frac{2}{3}$	$\frac{16}{9}$	
$5\frac{1}{2} \div 1\frac{3}{4}$	$\frac{11}{2} \div \frac{7}{4}$	$\frac{11}{2} \times \frac{4}{7}$	$\frac{44}{14} = \frac{\square}{\square}$	
$4\frac{3}{5} \div 2\frac{2}{3}$	$\frac{23}{5} \div \frac{8}{3}$	$\frac{23}{5} \times \frac{3}{8}$		
$7\frac{2}{3} \div 1\frac{1}{6}$	$\frac{23}{3} \div \frac{7}{6}$			
$3\frac{7}{8} \div \frac{3}{4}$				
$1\frac{4}{5} \div 2\frac{2}{3}$				
$4\frac{1}{6} \div 1\frac{5}{12}$				
$3\frac{3}{10} \div 1\frac{4}{5}$				
$5\frac{1}{2} \div 3\frac{2}{3}$				
	$\frac{19}{6} \div \frac{7}{5}$			
		$\frac{23}{9} \times \frac{3}{7}$		
$4\frac{1}{2} \div \square\frac{\square}{\square}$				$1\frac{7}{20}$

1.10 Fractions of Amounts

Worked Example	Your Turn
Calculate:	Calculate:
a) $\frac{3}{4}$ of 24	a) $\frac{2}{3}$ of 24
b) $\frac{7}{4}$ of 24	b) $\frac{5}{3}$ of 24

Worked Example	Your Turn
a) Increase 60 by $\dfrac{1}{5}$ b) Decrease 100 by $\dfrac{1}{5}$	a) Increase 60 by $\dfrac{4}{5}$ b) Decrease 200 by $\dfrac{3}{5}$

1.12 Reverse Fractions of Amounts

Worked Example	Your Turn
Find the value of x: a) $\dfrac{2}{5}$ of x is 12 b) $\dfrac{6}{5}$ of x is 12	Find the value of x: a) $\dfrac{3}{4}$ of x is 15 b) $\dfrac{5}{4}$ of x is 15

Worked Example	Your Turn
a) $\frac{2}{3}$ of an amount is 28 What is the total amount?	a) $\frac{4}{5}$ of an amount is 28 What is the total amount?
b) $\frac{4}{3}$ of an amount is 28 What is the total amount?	b) $\frac{7}{3}$ of an amount is 28 What is the total amount?

Fill in the Gaps

$\frac{4}{5}$ of the amount	$\frac{1}{5}$ of the amount	Total amount	$\frac{6}{5}$ of the amount
12	3	15	18
36	9		54
48			
84			
4			
20			
2			
		100	
		10.5	
			12
			18
			24
0.8			
			21

Fill in the Gaps

$\frac{3}{5}$ of the amount	$\frac{1}{5}$ of the amount	Total amount	$\frac{12}{5}$ of the amount
48	16	80	192
12	4		
1.2			
	$\frac{1}{10}$	$\frac{1}{2}$	
$\frac{3}{8}$			
			6
			7.2
			8.4
$\frac{1}{2}$			
$\frac{5}{3}$			

Fill in the Gaps

Q	Original Amount	Fraction Of	New Amount	Change
1	£60	$\frac{1}{4}$		
2	£60		£20	
3	£60			− £20
4		$\frac{2}{3}$	£20	
5	£30		£12	
6		$\frac{2}{5}$	£18	
7			£18	− £45
8		$\frac{6}{7}$		− £45
9	£315			− £0
10	£315	$\frac{8}{7}$		
11	£315		£585	
12	£315			+ £780.75

2 Decimals

Worked Example	Your Turn
Work out: $481.4 + 35.23$	Work out: $369.5 + 47.68$

2.2 Subtracting Decimals

Worked Example	Your Turn
Work out: $184.3 - 40.66$	Work out: $145.2 - 43.46$

Worked Example	Your Turn
$93 \times 76 = 7068$	$26 \times 89 = 2314$
a) Calculate 9.3×7.6	a) Calculate 2.6×89
b) Calculate 0.93×7.6	b) Calculate 2.6×0.89

Worked Example	Your Turn
Work out: 2.724×4	Work out: 1.745×7

Worked Example	Your Turn
Work out: 386.6×2.09	Work out: 379.6×4.23

Worked Example	Your Turn
Work out: $1246.24 \div 8$	Work out: $1197.21 \div 7$

Worked Example	Your Turn
Work out: $0.9 \div 0.003$	Work out: $0.06 \div 0.002$

3.1 Terminology

- An **expression** is a collection of letters and numbers with no equals sign, for example $3x + 1$

- An **equation** contains an equals sign and an unknown letter to be solved, for example $3x + 1 = 10$

- A **formula** is a relationship between two or more letters, and it contains an equals sign, for example $A = bh$

- An **identity** is an equation that is always true, no matter what values are substituted, for example $2x + 3x = 5x$ (use $\equiv$)

Frayer Model – Equation

Definition	**Characteristics**
Examples	**Non-Examples**

3.2 One Step

To solve an equation means that we find the value of the variable(s).

Strategy: To get x on its own on one side of the equation, we gradually need to 'claw away' the things surrounding it.

Note: In algebra, we tend to give our answers as fractions rather than decimals (unless asked). And never recurring decimals. Don't round also (unless asked).

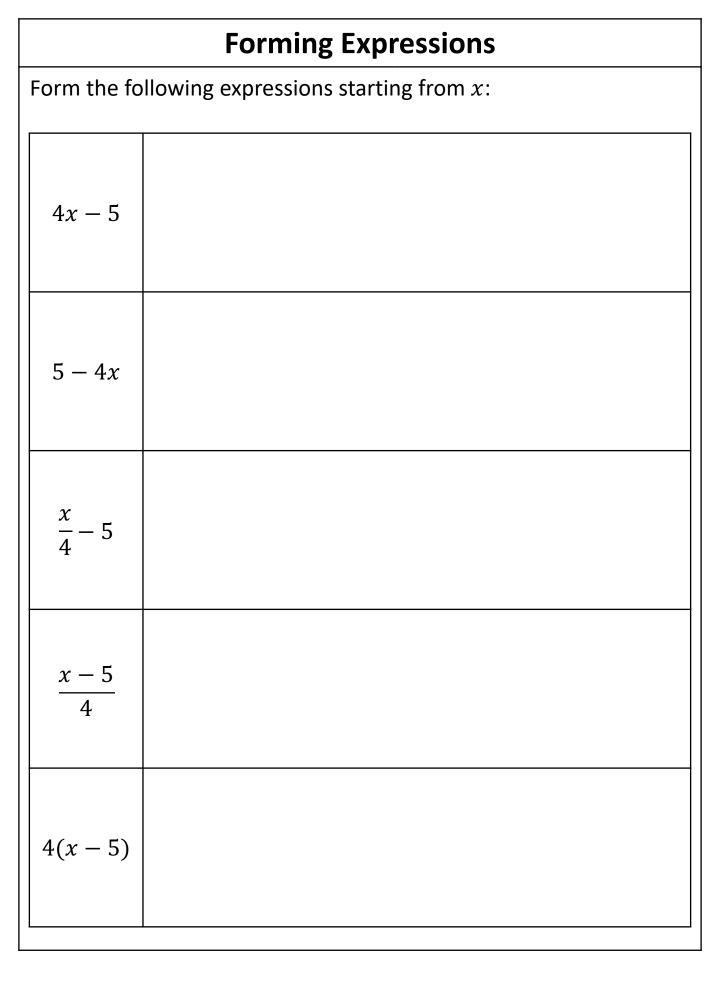| Worked Example	Your Turn
Solve the following equations: a) $x + 3.2 = 8.1$ b) $3.2 + x = 8.1$ c) $8.1 = x + 3.2$	Solve the following equations: a) $x + 6.5 = 11.1$ b) $6.5 + x = 12.1$ c) $11.1 = 7.5 + x$

Worked Example	Your Turn
Solve the following equations: a) $x - 3.9 = 8.7$ b) $3.9 - x = 8.7$	Solve the following equations: a) $x - 6.6 = 11.2$ b) $6.6 - x = 11.2$

Positive or Negative Solution

$x = -15$ +ve / -ve

$-x = \dfrac{15}{4}$ +ve / -ve

$\dfrac{-15}{4} = -x$ +ve / -ve

$4 = -15x$ +ve / -ve

$\dfrac{15}{4} = -x$ +ve / -ve

$\dfrac{-4}{15} = -x$ +ve / -ve

$-4 = -15x$ +ve / -ve

$\dfrac{-15x}{4} = 1$ +ve / -ve

$15x = 4$ +ve / -ve

Intelligent Practice

$3x = 15$	+ve / -ve	$\frac{x}{3} = -15$	+ve / -ve
$3x = -15$	+ve / -ve	$\frac{-x}{3} = -15$	+ve / -ve
$-3x = 15$	+ve / -ve	$\frac{x}{3} = 15$	+ve / -ve
$15 = -3x$	+ve / -ve	$\frac{-x}{3} = -15$	+ve / -ve
$15x = -3$	+ve / -ve	$-15 = \frac{x}{3}$	+ve / -ve
$-15x = -3$	+ve / -ve	$-15 = \frac{-x}{3}$	+ve / -ve
$I-15x = 3$	+ve / -ve	$\frac{15}{3} = -x$	+ve / -ve
$15x = 3$	+ve / -ve	$\frac{3}{15} = -x$	+ve / -ve
$-x = -3$	+ve / -ve	$\frac{-3}{15} = -x$	+ve / -ve
$-x = 3$	+ve / -ve		
$3 = -x$	+ve / -ve		
$-3 = -x$	+ve / -ve		

Worked Example	Your Turn
Solve the following equations: a) $2.3x = 12.88$ b) $\dfrac{x}{2.1} = 8.5$	Solve the following equations: a) $3.1x = 19.22$ b) $\dfrac{x}{6.4} = 4.2$

3.3 Forming Expressions

Forming Expressions

Form the following expressions starting from x:

$4x - 5$	
$5 - 4x$	
$\dfrac{x}{4} - 5$	
$\dfrac{x - 5}{4}$	
$4(x - 5)$	

3.4 Two Steps

To solve an equation means that we find the value of the variable(s).

Strategy: To get x on its own on one side of the equation, we gradually need to 'claw away' the things surrounding it.

Note: In algebra, we tend to give our answers as fractions rather than decimals (unless asked). And never recurring decimals. Don't round also (unless asked).

Worked Example	Your Turn
Solve the following equations: a) $4x + 17 = 43$ b) $17 + 4x = 43$	Solve the following equations: a) $6x + 27 = 53$ b) $27 + 6x = 43$

Worked Example	Your Turn
Solve the following equations: a) $4x - 17 = 43$ b) $17 - 4x = 43$	Solve the following equations: a) $6x - 27 = 53$ b) $27 - 6x = 53$

Worked Example	Your Turn
Solve the following equations: a) $\dfrac{x}{3} + 12 = 49$ b) $\dfrac{x+12}{3} = 49$	Solve the following equations: a) $\dfrac{x}{6} - 12 = 49$ b) $\dfrac{x-12}{6} = 49$

Worked Example	Your Turn
Solve the following equations:	Solve the following equations:
a) $\dfrac{2x}{3} + 12 = 49$	a) $\dfrac{5x}{6} - 12 = 49$
b) $\dfrac{2x+12}{3} = 49$	b) $\dfrac{5x-12}{6} = 49$