

Business Mathematics

Prepared by Dr. Faisal Hasan

Lecture NO 1

جامعة الجميع الذكية

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MTH 112

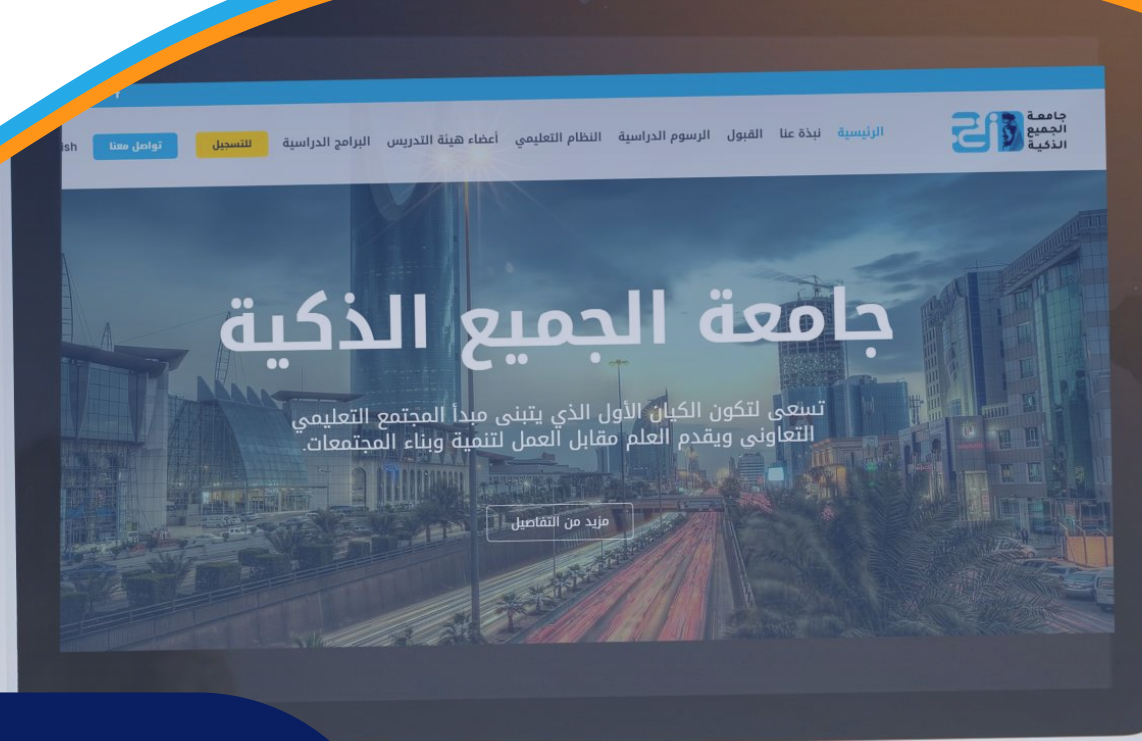
Business Mathematics



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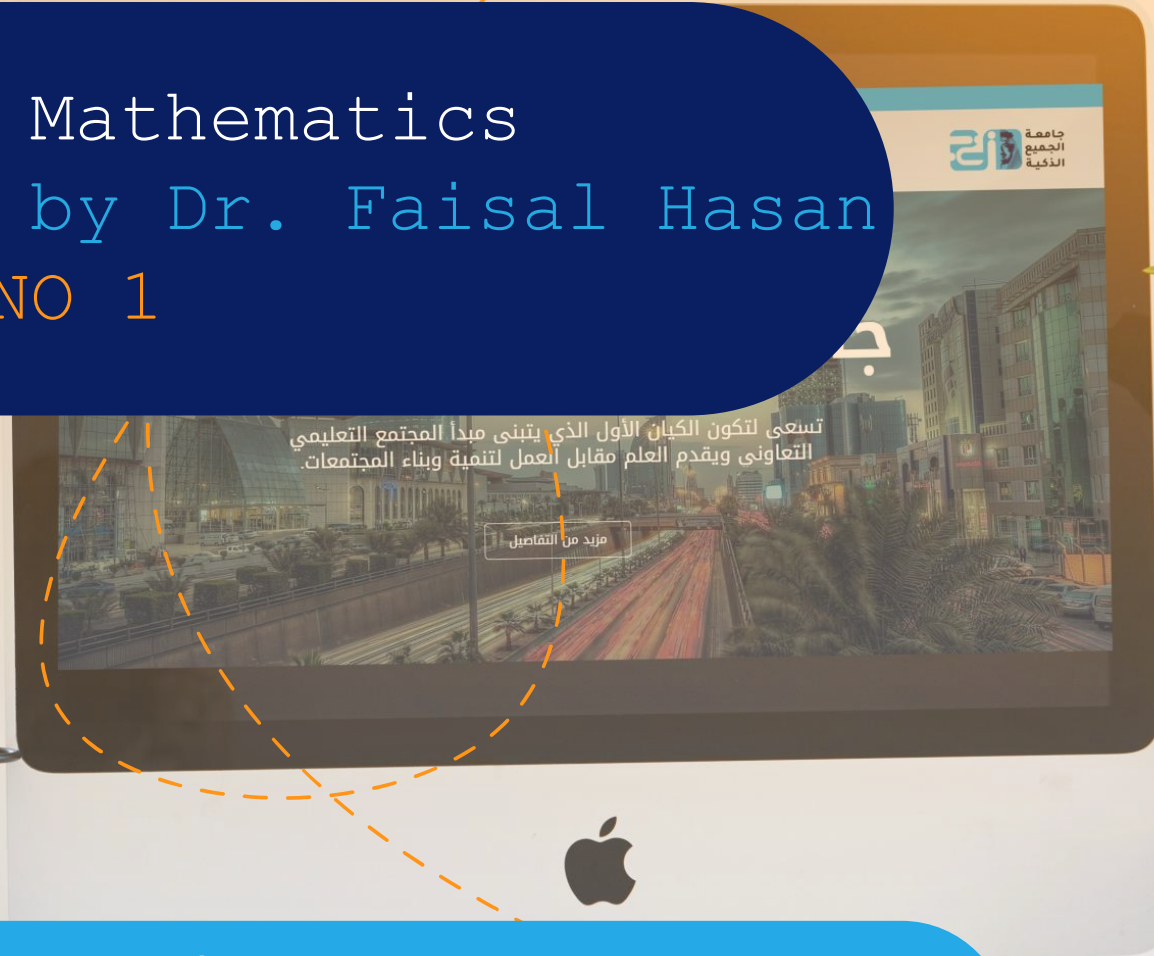
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MTH 112

Business Mathematics

Topics

- Chapter 1: Mathematical preliminaries
- Chapter 2: The straight line and applications
- Chapter 3: Functions and Graphs
- Chapter 4: Limits and Continuity
- Chapter 5: Financial Mathematics
- Chapter 6: Differentiation
- Chapter 7: Methods of Differentiation
- Chapter 8: Function of several variables
- Chapter 9: Integration and applications
- Chapter 10: Linear algebra and applications

Powers: positive whole numbers such as 2^4 which means
 $2 \times 2 \times 2 \times 2 = 16$

$$(\text{anything})^3 = (\text{anything}) \times (\text{anything}) \times (\text{anything})$$

$$(x)^3 = x \times x \times x$$

$$(x + 4)^5 = (x + 4)(x + 4)(x + 4)(x + 4)(x + 4)$$

Variables and letters: when we don't know the value of quantity, we give that quantity a symbol, such as x
This statements may be expressed as a mathematical equation:

$$15 \times \text{weekly savings} = 4000$$

$$15 \times x = 4000 \quad \text{or} \quad 15x = 4000$$

Now that the statement has been reduced to a mathematical equation, we may solve the equation for the unknown, x :

$$15x = 4000$$

$$\frac{15x}{15} = \frac{4000}{15} \quad \text{divide both sides of the equation by 15}$$

$$x = 266.67$$

Square roots: the square root of a number is the reverse of squaring:

$$(2)^2 = 4 \rightarrow \sqrt{4} = 2$$

$$(2.5)^2 = 6.25 \rightarrow \sqrt{6.25} = 2.5$$



Adding: If all the signs are the same, simply add all the terms and give the answer with the common overall sign.

Subtracting: When subtract any two numbers or any two similar terms, give the answer with the sign of the largest number or terms.

Add/subtract with numbers, mostly

$$5 + 8 + 3 = 16 \quad \text{similarity} \rightarrow$$

$$5 + 8 + 3 + y = 16 + y \quad \text{similarity} \rightarrow$$

The y -term is different, so it cannot be added to the others

Add/subtract with variable terms

$$5x + 8x + 3x = 16x$$

$$(i) \quad 5x + 8x + 3x + y = 16x + y$$

$$(ii) \quad 5xy + 8xy + 3xy + y = 16xy + y$$

The y -term is different, so it cannot be added to the others

$$7 - 10 = -3 \quad \text{similarity} \rightarrow$$

$$7 - 10 - 10x = -3 - 10x \quad \text{similarity} \rightarrow$$

The x -term is different, so it cannot be subtracted from the others

The y -term is different, so it cannot be added to the others

$$(i) \quad 7x - 10x = -3x$$

$$(ii) \quad 7x^2 - 10x^2 = -3x^2$$

$$7x^2 - 10x^2 - 10x = -3x^2 - 10x$$

The x -term is different, so it cannot be subtracted from the others



Terminology:

$$\text{fraction} = \frac{\text{numerator}}{\text{denominator}}$$

$$\frac{3}{7} \quad \leftarrow 3 \text{ is called the numerator}$$

$$\quad \leftarrow 7 \text{ is called the denominator}$$



Numerical example

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

Step 1: The common denominator
is (7)(3)(5)

$$\text{Step 2: } \frac{1}{7} + \frac{2}{3} - \frac{4}{5}$$

$$= \frac{1(3)(5) + 2(7)(5) - 4(7)(3)}{(7)(3)(5)}$$

$$\text{Step 3: } = \frac{15 + 70 - 84}{105} = \frac{1}{105}$$



$$(a) \quad \left(\frac{2}{3}\right)\left(\frac{5}{7}\right) = \frac{(2)(5)}{(3)(7)} = \frac{10}{21}$$

$$(b) \quad \left(-\frac{2}{3}\right)\left(\frac{7}{5}\right) = \frac{(-2)(7)}{(3)(5)} = \frac{-14}{15}$$

$$(c) \quad 3 \times \frac{2}{5} = \left(\frac{3}{1}\right)\left(\frac{2}{5}\right) = \frac{(3)(2)}{(1)(5)} = \frac{6}{5} = 1\frac{1}{5}$$

The same rules apply for fractions involving variables, x , y , etc.

$$(d) \quad \left(\frac{3}{x}\right)\frac{(x+3)}{(x-5)} = \frac{3(x+3)}{x(x-5)} = \frac{3x+9}{x^2-5x}$$



- What do you notice about each of the following?

$$6 + 3 = 9$$

$$5 - 3 = 2$$

$$5 + 3 = 1 + 7$$

$$x = 4.$$

$$2x = x + x$$

$$3x = 2x + x = x + x + x$$



- What does this picture represent?
- What is this apparatus called?

What is an equation?

Equation - a balanced statement of equality between two quantities.

$$4 + 3 = 7$$

$$\begin{array}{ccc} 4 + 3 & = & 7 \\ \hline \end{array}$$

Solve.

$$\begin{array}{r} \text{a) } m + 2 = 10 \\ -2 \quad -2 \\ \hline m = 8 \end{array}$$

$$\begin{array}{r} \text{c) } m - 4 = 9 \\ +4 \quad +4 \\ \hline m = 13 \end{array}$$

$$\begin{array}{r} \text{b) } x - 4 = 6 \\ +4 \quad +4 \\ \hline x = 10 \end{array}$$

$$\begin{array}{r} \text{d) } x + 7 = 3 \\ -7 \quad -7 \\ \hline x = -4 \end{array}$$

Solve.

$$\begin{array}{rcl} \text{a) } -4 + x & = & 15 \\ +4 & & +4 \\ \hline & x = & 19 \end{array}$$

$$\begin{array}{rcl} \text{b) } 7 & = & x + 13 \\ -13 & & -13 \\ \hline & -6 = & x \end{array}$$

$$\begin{array}{rcl} \text{c) } -4 & = & m + 9 \\ -9 & & -9 \\ \hline & -13 = & m \end{array}$$

$$\begin{array}{rcl} \text{d) } 9 + 7 & = & x \\ & 16 = & x \end{array}$$

Solve.

$$\text{a) } \frac{5x}{5} = \frac{35}{5}$$

$$x = 7$$

$$\text{b) } \frac{9}{-3} = \frac{-3m}{-3}$$

$$-3 = m$$

Solve.

$$2) \quad 12 = \frac{x}{-6}$$

$$(-6) \cdot 12 = \frac{x}{\cancel{-6}} \cdot \cancel{(-6)}$$

$$\boxed{-72 = x}$$

$$4) \quad y \div 4 = -8$$
$$\quad \times 4 \quad \times 4$$

$$\boxed{y = -32}$$

$$\frac{-4k}{-4} = \frac{14}{-4}$$

$$k = \left(-\frac{7}{2}\right) = \left(-3\frac{1}{2}\right) = (-3.5)$$

All answers must be fully reduced

Chapter 01

Solving Equations involving fractions

Solve. $\frac{3}{5}x = 9$

$$\left(\frac{5}{3}\right) \frac{3}{5} x = 9 \left(\frac{5}{3}\right)$$

$$x = \frac{9}{1} \bullet \frac{5}{3} = \frac{45}{3}$$

$$x = 15$$

Easier to multiply by the reciprocal!

Solve.

$$\text{a) } \left(\frac{7}{2} \right) \frac{2}{7} y = 14 \left(\frac{7}{2} \right)$$

$$y = \frac{14}{1} \cdot \frac{7}{2}$$

$$x = 49$$

$$\text{b) } \left(\frac{7}{2} \right) 16 = \frac{2}{7} x \left(\frac{7}{2} \right)$$

$$\frac{7}{2} \cdot \frac{16}{1} = x$$

$$56 = x$$

Solve.

$$\text{a) } \left(\frac{-3}{2} \right) \frac{-2}{3} m = 18 \left(\frac{-3}{2} \right)$$

$$m = \frac{18}{1} \bullet \frac{-3}{2}$$

$$m = -27$$

$$\text{b) } \left(\frac{-5}{4} \right) \frac{-4}{5} m = 9 \left(\frac{-5}{4} \right)$$

$$m = \frac{9}{1} \bullet \frac{-5}{4}$$

$$m = \frac{-45}{4} = -11\frac{1}{4}$$

An **inequality** is like an equation, but instead of an equal sign (=) it has one of these signs:

$<$: less than

$\leq$: less than or equal to

$>$: greater than

$\geq$: greater than or equal to

$$x < 5$$

means that whatever value x has,
it must be less than 5.

What could x be?

$$x \geq -2$$

means that whatever value x has,
it must be greater than or equal to -2 .

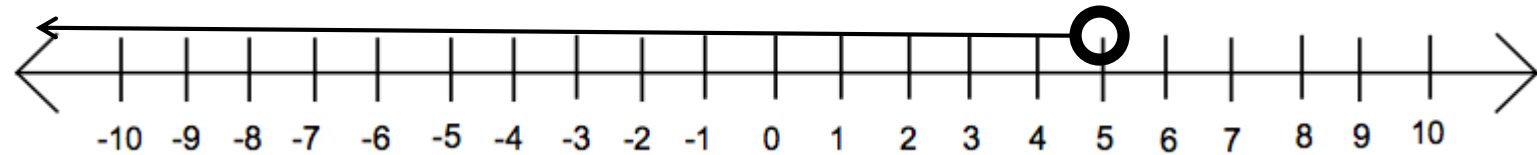
What could x be?

Graphing Rules

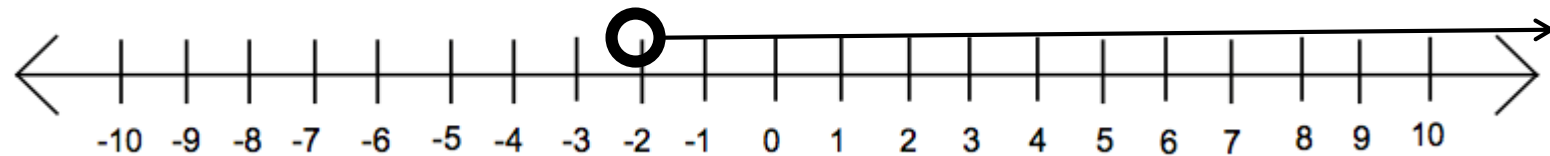
Symbol	Circle	Direction of Arrow
$<$	Open	Left
$>$	Open	Right
$\leq$	Closed	Left
$\geq$	Closed	Right

Examples:

$$x < 5$$

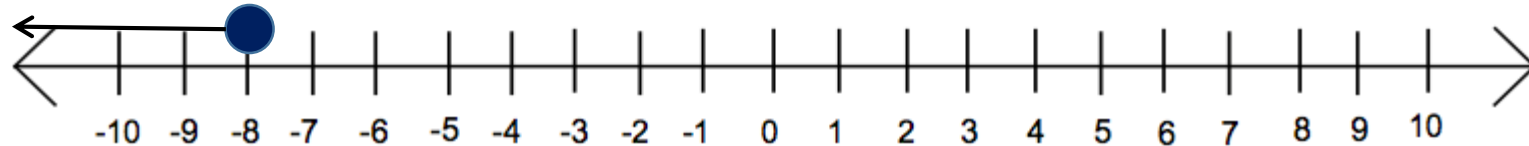


$$x > -2$$

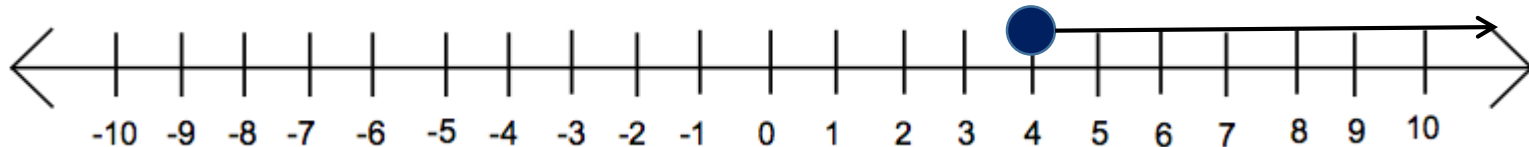


Examples:

$$x \leq -8$$



$$x \geq 4$$



$$\frac{x}{5} = 10$$

Multiply both
sides by the
reciprocal of the
coefficient

$$5 \times \frac{x}{5} = 10 \times 5$$

$$x = 50$$



$$5x > 20$$

Divide both
sides by the
coefficient of x

$$\frac{5x}{5} > \frac{20}{5}$$

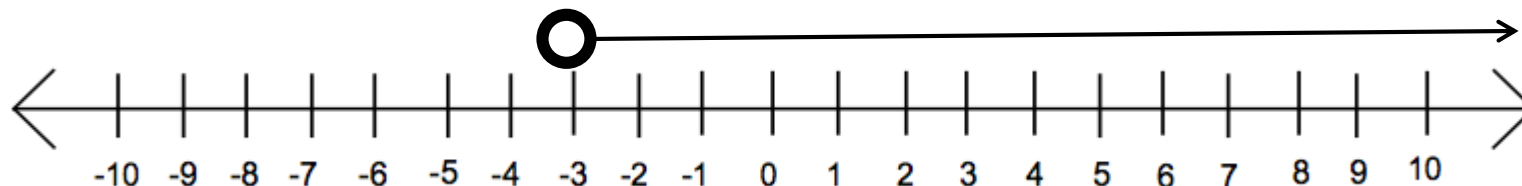
$$x > 4$$

- Solving inequalities is the same as solving equations.
- There are only 2 things you need to know...
 - 1.) If you multiply or divide by a negative number you must switch the sign.

$$\begin{array}{rcl} -7x & < & 21 \\ \hline -7 & & -7 \\ \hline x & > & -3 \end{array}$$

Dividing by a negative means switch the sign!!

2.) You will graph your solutions.



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Caution! Dividing by
a negative number

$$-5x < 20$$



$$\frac{-5x}{-5} < \frac{20}{-5}$$



$$x > -4$$

Same if multiplying?

Notice: Sign
CHANGED

Caution! When you multiply by a negative number...

YES!

$$\frac{-x}{5} > 2$$

...the sign
CHANGES

$$\frac{(-5) \cdot (-x)}{1 \cdot 5} > 2(-5)$$

$$x < -10$$



- Follow same steps used to solve equations:

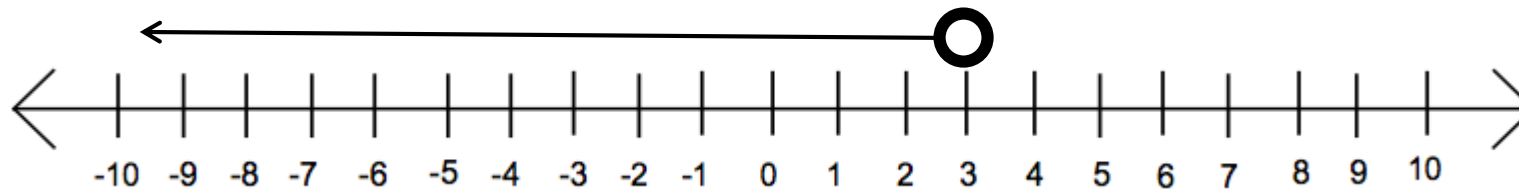
$$3x + 4 < 13$$

$$\quad -4 \quad -4$$

$$3x < 9$$

$$\quad 3 \quad 3$$

$$x < 3$$



Find the value of

$$\left(\frac{2}{9}\right)\left(\frac{1}{7}\right)$$



Find the value of

$$\left(\frac{3}{11}\right)\left(\frac{2}{5}\right)$$



Find the value of

$${}^{(4)}\left(\frac{2}{5}\right)$$



Solve the equation

$$3x - 4 = x + 5$$



Solve the inequality

$$3x - 4 < x + 5$$

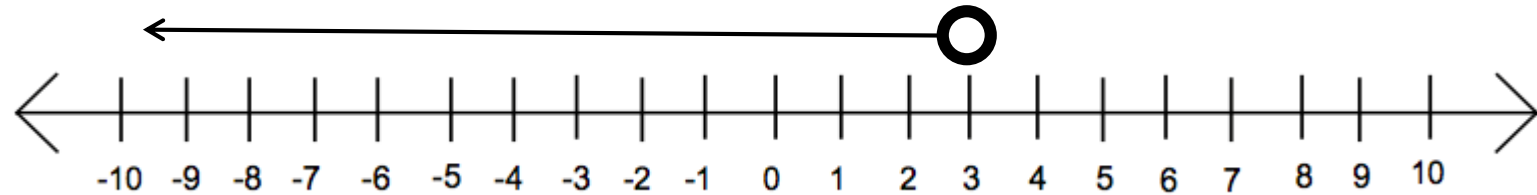


Solve the inequality

$$-3x \leq 30$$



Write the solution



Write the solution

