Relationships of numbers } *

→ odd numbers = { 1, 3, 5, 7 . . }

→ Cant be devided into pairs

→ Cant be devided by 2

→ Even numbers {2; 4; 6; 8}

→ multiples of 2

LCM

HCF ✗

LCM (Least Common Multiple)

* ① Prime numbers, (can only be divided by 1 & Self)
  ↳ {2, 3, 5, 7 ...}

*

5	30
2	6
3	3
1	1

$30 = 5 \times 2 \times 3 \times 1$

*List 45 as a product of its Prime factors. (Using the tree method)

5	45
3	9
3	3
1	1

Prime (1, 2, 3, 5)

① $45 = 5 \times 3 \times 3 \times 1$

$30 = 5 \times 3 \times 2 \times 1$

② Group prime factors

$5 \times 3 \times 3 \times 2 \times 1 = 90 \times 1$

90

LCM = 90

LCM

3	9
3	3
1	1

9 & 21

3	21
7	7
1	1

Tree method

$9 = 3 \times 3 \times 1$

$21 = 3 \times 7$

$3 \times 7 \times 3 \times 1 = 63$

Short way

LCM

① 12 & 80

② 15 & 21

③ 12 & 8

④ 24 & 36

LCM

12 & 80

multiply all prime factors.

3	12
2	4
2	2
1	1

5	80
2	16
2	8
2	4
2	2
	1

$12 = 3 \times 2^2 \times 1$

$80 = 5 \times 2^4 \times 1$

$= 5 \times 2^2 \times 2^2 \times 1$

$= 240$

15 & 4 & 21

5	15
3	3
	1

3	21
7	7
	1

$15 = 5 \times 3 \times 1$

$21 = 7 \times 3 \times 1$

$LCM = 7 \times 5 \times 3 \times 1$

$= 105$

HCF * Factors / All factors

$8 = \{1, 2, 4, 8\}$

$12 = \{1, 2, 3, 4, 6, 12\}$

HCF of 8 & 12 is 4

HCF 8 4 12 Pure factors

2	8
2	4
2	2
1	1

3	12
2	4
2	2
1	1

$8 = 2 \times 2 \times 2 \times 1$

$12 = 3 \times 2 \times 2 \times 1$

$4 = 2 \times 2 \times 1$

NB

we only need prime factors that are common in both lines (numbers)

* Pairs

Find the LCM & HCF of 8 & 12

* method: Tree method

HCF

2	8
2	4
2	2
1	1

3	12
2	4
2	2
1	1

$8 = 2 \times 2 \times 2 \times 1$

$12 = 3 \times 2 \times 2 \times 1$

$4 = 2 \times 2 \times 1$

LCM.

2	8
2	4
2	2
1	1

3	12
2	4
2	2
1	1

$8 = 2 \times 2 \times 2 \times 1$

$12 = 3 \times 2 \times 2 \times 1$

$24 = 3 \times 2 \times 2 \times 2 \times 1$

Find (a) LCM & (b) HCF of the following:

① 20 & 30 ⟶ ϕ

② 60 & 72

HCM = 60

HCF = 10

HCF

$20 = 5 \times 2 \times 2 \times 1$

$30 = 5 \times 3 \times 2 \times 1$

$10 = 5 \times 2 \times 1$

Pairs

5	20
2	4
2	2
1	1

5	30
3	6
2	2
1	1

①

LCM

$20 = 5 \times 2 \times 2 \times 1$

$30 = 5 \times 3 \times 2 \times 1$

$60 = 5 \times 2 \times 3 \times 2 \times 1$

All factors.

Laws of Exponents

* When we have unknown values.
* value Powers (exponents)

$y = x^2$ — 2 — Exponent.

Base 10

— Base

* Laws of Exponents:

→ function same base variables

① Multiplication

Add.

$$x^m \times x^n = x^{m+n}$$

$$x^m \times y^n \neq x^m y^n$$

eg: $x^3 \times x^5$

$= x^{3+5}$

$= x^8$

$x^2 \times x^6 = x^?$

$= x^{2+6}$

$= x^8$

② Quotient (fractions). Sub

$$x^m \div x^n = x^{m-n}$$

$$x^5 \div x^7 = x^{5-7}$$

$$= x^{-2}$$

$$= \frac{1}{x^2}$$

$$x^{-m} = \frac{1}{x^m}$$

$$2x^4 \div 4x^2$$

$$= \frac{1}{2} x^{4-2} \Rightarrow \frac{1}{2} x^2$$

$0{,}5\,x^{-2}$ → fractions

Powers

$$(x^m)^n$$

$$= x^{m \times n}$$

$$= x^{mn}$$

eg $(x^7)^3 = x^{21}$

$(2x^7)^3 = 2^3 \cdot x^{7 \times 3}$

$= 2^3 x^{21}$

$= 8x^{21}$

Power

How many time does a number multiply itself.

2×3

$2 \times 2 \times 2$

Derived law

$$\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$$

$$= \left(\frac{1}{2}\right)^x$$

$$= \left(\frac{1^x}{2^x}\right)$$

Fraction Power Root

$$x^{\frac{n}{m}} = \sqrt[m]{x^n}$$

$$x^{3/2} = \sqrt[2]{x^3}$$

$$\Rightarrow x^{1/2} = \sqrt[2]{x^1}$$

$$49^{1/2} = \sqrt[2]{49^1}$$

$$49^{1/3} = \sqrt[3]{49^1}$$

$$20x^{1/2} = 20 \times \sqrt[2]{x}$$

$$(20x)^{1/2} = \sqrt[2]{20x}$$

$$(20x)^{3/2} = \sqrt[2]{(20x)^3}$$

$$= \sqrt[2]{20^3 x^3}$$

Questions

① 3^{-2}

neg powe

$x^{-m} = \frac{1}{x^m}$

$3^{-2} = \frac{1}{3^2}$

$= \frac{1}{9}$ //

② $\left(\frac{4}{7}\right)^{-3}$

$= 4^{-3}$

$\frac{4}{7^{-3}}$

$= \frac{1}{4^3} \Big/ \frac{1}{7^3}$

③ $(a^2)^2 \div a^3$

$a^{2\times 2} \div a^3$

$= a^4 \div a^3$

$= a^{4-3}$

$= a^1$

$= a$ ▷

$$= \frac{1}{64} \div \left(\frac{1}{343}\right)$$

→ Div into multiplicatio

→ 'invert a value.

$$= \frac{1}{64} \times \frac{343}{1}$$

$$= \frac{343}{64}$$

$$\left(\frac{y^2}{4y}\right)^{-\frac{1}{2}}$$ Derived Law

$$= (y^2)^{-\frac{1}{2}} \checkmark \rightarrow \text{Power}$$

$$= \frac{}{(4y)^{-\frac{1}{2}}} \checkmark \rightarrow \text{Power}$$

$$= \frac{y^{\frac{1}{2}\times -\frac{1}{2}}}{4^{-\frac{1}{2}}\, y^{-\frac{1}{2}}} \quad \underline{\text{neg law}}$$

$$= \frac{y^{-1}}{\frac{1}{4^{1/2}\, y^{1/2}}} \quad x^{-1} = \frac{1}{x} \quad \checkmark$$

$$= \frac{1}{y} \div \frac{1}{\sqrt[2]{4}\cdot\sqrt[2]{y}} \quad \underline{\text{Division} \rightarrow \text{fractional}}$$

$$= \frac{1}{y} \div \frac{1}{2y^{1/2}}$$

$$= \frac{1}{y} \times \frac{2y^{1/2}}{1} = \frac{2y^{1/2}}{y^1}$$

① $(-10z^2y^{-4})^2$

- Power law

$= -10^2 z^{2\times2} y^{-4\times2}$

$= 100 z^4 y^{-8}$

$= \frac{100z^4}{y^8}$

$-10^2 = -10 \times -10$

$= 100$

$$\frac{n^{-2}m}{7m^{-4}n^{-3}} = \frac{n^{-2}}{n^{-3}} \cdot \frac{m^1}{7m^{-4}} - \frac{1}{7}$$

$n \Rightarrow$ Double -ve

Becomes +ve

$$= \frac{\text{Quotient Rule.}}{x^m \div x^n = x^{m-n}}$$

$$= n^{-2-(-3)} \cdot m^{1-(-4)}$$

$$= n^{-2+3} \cdot m^{1+4}$$

$$= n^1 \cdot m^5$$

$$= \frac{1}{7} n m^5$$

$$= \frac{5x^{-1}y^{-4}}{(3y^5)^{-2}x^9}$$

$$= \frac{5x^{-1}y^{-4}}{3^{-2}y^{-10}x^9}$$

$$= \frac{5}{3^{-2}} \cdot x^{-1-9} \cdot y^{-4-(-10)}$$

$$= \frac{5}{3^{-2}} x^{-10} \cdot y^{6}$$

$$= 5 \times 3^2 x^{-10} \cdot y^6$$

$$= 5 \times 9\, x^{-10} \cdot y^6$$

$$= 45 x^{-10} y^6$$

$$= \left\{ \frac{45y^6}{x^{10}} \right\}$$

Exponential Equation

* Tool/method to solve unknow variable.
* Interpolation.
  → GIS methods that finds unknow values

* $3x = 6$

find value of x

$\frac{3}{3}x = \frac{6}{3}$

1

$= x = 2$

$7(2x+5) = 2$

BODMAS

①

② factor in 7

$14x + 35 = 2$

③ group like terms

$14x = -35 + 2$

$\frac{14x}{14} = \frac{-33}{14}$

Simplify

$x = \frac{-33}{14}$

Exponents

* Bases.
* Same Base to be able to simplify

$3^x = 3^5$

* If Bases the same: Negate Base.
* focus on exponents.

$x = 5$ ✓

RB: $3^x \neq 5^3$

$x \neq 3$

Base not the same.

$5^x = 125$

* five factor of 125
trial & error.

* change 125 to a power of 5

$5^x = 5^3$

Same Bases:

$x = 3$

$5^2 = 5 \times 5 = 25$

$5^3 = 5 \times 5 \times 5 = 125$

$4^x = 8$

$2^{2(x)} = 2^3$

Base are te same

$2x = 3$

$\frac{2}{2}$ $\frac{x}{1} = \frac{3}{2}$

$x = \frac{3}{2}$

Powers

* $4 = 2^2$
* $8 = 2^3$

$\sqrt{4} = 2$

$\sqrt[3]{8} = 2$

$$16^x = \frac{1}{4}$$

$$\underline{4^{2x}} = \underline{4^{-1}}$$

Base is the same

$$\frac{2x}{x} = \frac{-1}{2}$$

$$x = -\frac{1}{2}.$$

$\sqrt{16} = 4$ — Power

$4 =$ tower.

fraction (-ve law).

$* \quad 4^{-1}$

Questions

① find the LCM & HCF of 80 & 72

② Evaluate : (a) $36^{\frac{1}{2}}$ (b) $\left(\frac{9}{4}\right)^{\frac{1}{2}}$ (c) $\left(\frac{9}{4}\right)^{-\frac{1}{2}}$

(a) $36^{\frac{1}{2}}$

$x^{\frac{1}{2}} = \sqrt{x}$

$\sqrt{36}$

$= 6$ ⟹

(b) $\frac{9^{\frac{1}{2}}}{4^{\frac{1}{2}}}$

$= \frac{\sqrt{9}}{\sqrt{4}}$

$= \frac{3}{2}$ ⟹

(c) $\frac{\left(\frac{m}{n}\right)^{-1}}{= \left(\frac{n}{m}\right)^{1}}$

$= \left(\frac{4}{9}\right)^{\frac{1}{2}}$

$$\left(\frac{2x}{4x^2}\right)^{-\frac{1}{2}}$$

$$= \left(\frac{4x^2}{2x}\right)^{\frac{1}{2}}$$

$$= \frac{4^{1/2} \cdot x^{2(1/2)}}{2^{1/2} x^{1/2}}$$

$$= \frac{\sqrt{4}\,x}{\sqrt{2}\sqrt{x}}$$

$$= \frac{\sqrt{4}\cdot x}{\sqrt{2x}}$$

$7^{2x-5} = 27$

$x = \frac{13}{4}$

$3^{2(2x-5)} = 27$

$3^{2(2x-5)} = 3^3$

$2(2x-5) = 3$

$4x - 10 = 3$

$4x = 13$

① $4^{3x+5} = 8^{4x-3}$

② $3^{2x-5} = 81$

$\left(2^2\right)^{3x+5} = \left(2^3\right)^{4x-3}$

$2^{6x+5} = 2^{12x-3}$

$6x+5 = 12x-3$

$5+3 = 12x-6x$

$\frac{8}{6} = \frac{6x}{6}$

$x = \frac{8}{6}$

$x = 1\frac{2}{6} = 1\frac{1}{3}$

② $3^{2x-5} = 3^4$

$2x-5 = 4$

$2x = 5+4$

$\frac{2x}{2} = \frac{9}{2}$

$x = 4\frac{1}{2}$

$16^x = \frac{1}{4}$ *

$16^x = 4^{-1}$

$(4^2)^x = 4^{-1}$

$4^{2x} = 4^{-1}$

$2x = -1$

$x = \frac{-1}{2}$

* negetive law.

$8^{2x+1} = 1$

$8^{2x+1} = 8^0$

$x^0 = 1$

$2x + 1 = 0$

$\frac{2x}{2} = -\frac{1}{2}$

$x = -1/2$

Logs

* exponent > 0
* Method to represent numbers.
  * Natural log
    → e = 2,718281.... (natural)
  * Common log
    → $\log_{10}$
* Simplify exponent.

$\log_{10} 5 =$

$\log \frac{5}{3} = \log_{10} 5 - \log_{10} 3$

Relationship between log & Expn

Log $\square$ $\square$ — coefficient.

log function

Base

$$\text{Log}_x y = c \Leftrightarrow y^c = x$$

* make the exponent the subject of the formular.

$$243 = 3^5$$

$$\log_3 243 = 5$$

(eg) $4 = 8^x$ — Exponent

Base

$$\log_8 4 = x$$ — Exponent (resultant)

Base.

① $2^x = 4$

Evaluate x not a log

$\log_2 4 = x$

② $\log_2 32 = x$

Expanent.

$2^x = 32$

① $\log_2 x = 5$

② $\log_{36} x = -\frac{1}{2}$

③ $\log_7 x = 2$

④ $7^3 = 343$

$\log_7 343 = 3$

$\log_2 x = 5$

$\Rightarrow 2^5 = x$

$\Rightarrow x = 32$

$2 \times 2 \times 2 \times 2 \times 2$

$4 \quad 8 \quad 16 \quad 32$

$\log_{36} x = \frac{1}{2}$

$36^{-\frac{1}{2}} = x$ ✓

$\left(\frac{1}{36}\right)^{\frac{1}{2}} = x$ ✓

$\frac{1}{6} = x$ ✓

$\frac{1}{6}$

$$\log_7 x = 2$$

$$7^2 = x$$

$$x = 49$$

Laws of Logs

① $\log_x 1 = 0$

$x^0 = 1$

② $\log_x x = 1$

$\log_{30} 30 = 1$

$30^1 = 30$

③ $\log_a \frac{x}{y} = \log_a x - \log_a y$

④ $\log_a xy = \log_a x + \log_a y$

⑤ $\log_a x^y = y \log_a x$

$\log_{10} 2^3 = 3 \log_{10} 2$

$\log_{10} 3^3 = \log 3^3$

$\log_{10} 2^3 + \log_2 3^3$

$$\log_4 \frac{1}{x} = \log_4 x^{-1}$$

$$= -1 \log_4 x$$

Question Type:

1. Expand the log. ✓
2. Simplify the log. ✓

$$\log_2 8 + \log_2 16$$

$$= \log_2 2^3 + \log_2 2^4$$

$$= 3\log_2 2 + 4\log_2 2$$

$$= 3(1) + 4(1)$$

$$= 7$$

$\Rightarrow$

$$\log_a xy = \log_a x + \log_a y$$

* Simplify using Powers.
* Same Base $\rightarrow$ value.

$$\log_2 2 = 1$$

$$\log_a x = 1$$

$$\log_2 162 - \log_2 2 = \log_2\left(\frac{162}{2}\right)$$

$$\log_4 x - \log_4 y = \log_2 81 \quad ①$$

$$= \log_4\left(\frac{x}{y}\right) \qquad = \log_2 3^5 \quad ②$$

$$= 5\log_2 3 \quad ③$$

$4 = p$

$$\log_{\frac{1}{8}}\left(\frac{1}{64}\right) = \log_{\frac{1}{8}} 1 - \log_{\frac{1}{8}}(64)$$

$$= \log_{\frac{1}{8}} 1 - \log_{\frac{1}{8}} 64$$

Questions

$$\log_a\left(\frac{x^2}{y^3 \cdot a}\right)$$

Expand.

$$\log_a x^2 - (\log_a y^3 + \log_a a)$$

$$2\log_a x - 3\log_a y - 1$$

$$2\log_a x - 3\log_a y - 1$$

$$\log_a\left(\frac{ab^5}{c^3}\right)\} = \log_a ab^5 - \log_a c^3$$

$$= 1\left(\log_a a + 5\log_a b\right) - 3\log_a c$$

$$= \underline{\log_a a} + 5\log_a b - 3\log_a c$$

$$= 1 + 5\log_a b - 3\log_a c$$

Questions

Simplify

① $\log_b x^2 + \log_b x^3 - \log_b x^4$

② $\log_7 \frac{15}{2}$

③ $\log_5 6$

Given that

$a = \log_7 2$

$b = \log_7 5$

$c = \log_7 3$

Conclusions

*. Substitutes

* Ensure that the variable we get are the same as the condition.

$\log_b x^2 + \log_b x^3 - \log_b x^4$ BODMAS

$= \log_b x^2 \cdot x^3 - \log_b x^4$

$= \log_b \left(\frac{x^5}{x^4} \right)$

$= \log_b x^{5-4}$

$= \log_b x^1$

$$\log_7 \frac{15}{2} =$$

$$\log_7 15 - \log_7 2$$

$$\log_7 (3 \times 5) - \log_7 2$$

$$\log_7 3 + \log_7 5 - \log_7 2$$

$$c + b - a$$

where:

$a = \log_7 2$

$b = \log_7 5$

$c = \log_7 3$

$$\log_7 6 = \log_7 (3 \times 2)$$

$$= \log_7 3 + \log_7 2$$

$$= a + c$$

3	6
2	2
1	1

Write as a single Log:

① $\frac{2}{3}\log x - \frac{1}{3}\log y$

$= \log x^{2/3} - \log y^{1/3}$

$= \log \sqrt[3]{x^2} - \log \sqrt[3]{y}$

$= \log \frac{\sqrt[3]{x^2}}{\sqrt[3]{y}} \Rightarrow \log \frac{x^{2/3}}{y^{1/3}}$

$\frac{1}{2}\log x - 7\log y + \log z$

$= \log x^{1/2} - \log y^7 + \log z$

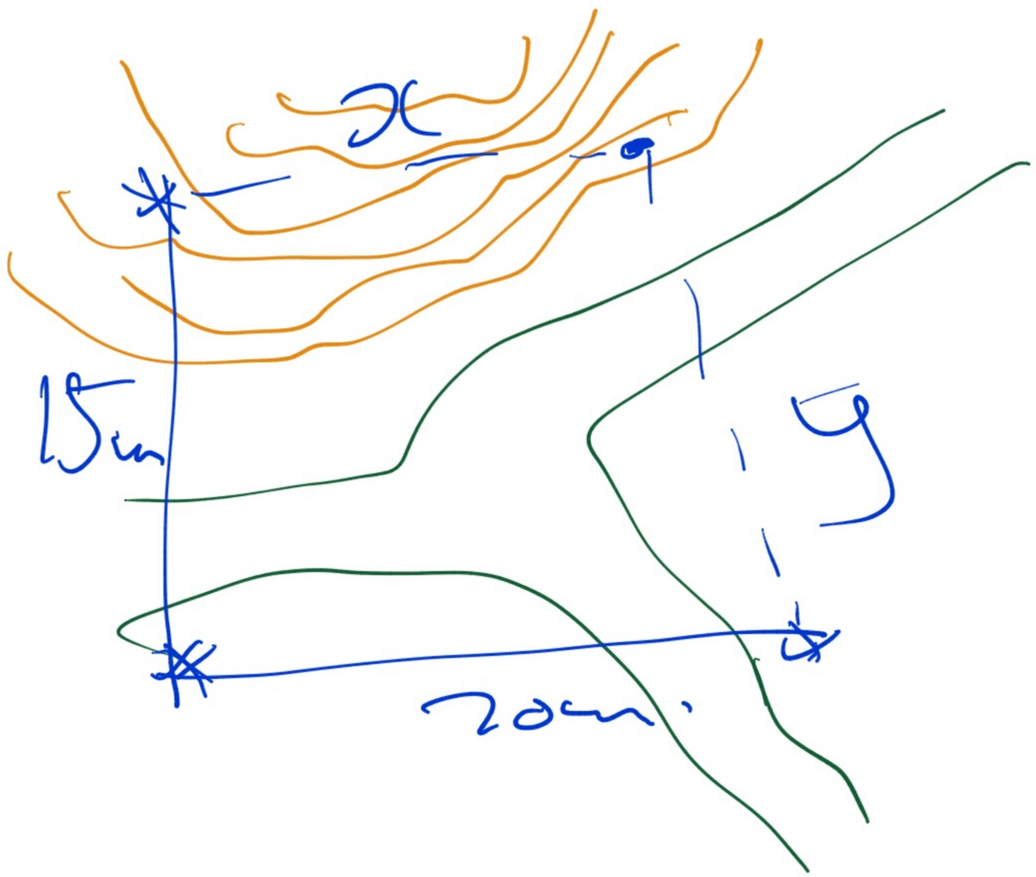
$= \log x^{1/2} - \log y^7 \cdot z$

$= \log \frac{x^{1/2}}{y^7 z}$

$= \log \frac{\sqrt{x}}{y^7 z}$

Algebra

* Common maths method that allows us to account missing variable.
* Letters to represent unknown variable.
* Used to create formulars.
* Variable (x, y, z) → Symbols



* Trig, Coordinate Geo
* Unknown variable

→ Term.

$3y^2$ → Exponet.

Coefficient.

Variable.

* How do we use our operations when working with terms.

$3x^2 + 6x + 4$

How many terms do I have.

$3x^2$, $6x$, 4

→ like terms combine.

→ factorization:

$3x^2 - 4x^2$

$= (3-4)x^2$ ← constant variable.

$= -1x^2$

$= -x^2$

$4x^2 + 4x \neq$

$4x^2 \times 4x = 16x^3$

$\times 1(4x - 5) - 2x$

$= 4x - 5 - 2x$

$= 4x - 2x - 5$

$= 2x - 5$

Addition & Sub
Same variable

$2x^* \rightarrow$ monomial.

$2x \quad -5$

Binomial.

$2x - 5x^2 + 1$

Trinomial.

$2x - 5x + 1 \ldots$

Polynomial.

Monomial & Binomial.

$7x(3x - 5)$ → factoring in *

$= 21x^2 - 35x$ → factor out *

$= 7x(3x - 5)$

* Expanding your terms/Expression

LCF = Coefficients.

LCF = Variable.

Write the following in its simplest form → simplify

① $3x^2(5x+7)$

② $9x+1(20-5x)$

① $15x^3+21x^2=$

② $9x+20-5x$

$=9x-5x+20$

$=4x+20$ ⟹

$$6(2j+3c)+8(5c+4j)$$

BODMAS

Steps

$$=12j+18c+40c+32j$$

① Dissolve Brackets

$$=12j+32j+18c+40c$$

② group like terms

$$=44j+58c$$

③ simplify

Questions

$$10(x+2)+7(3-4x)$$

$10(x+2)+3(3-4x)$

$=10x+20+21-28x$ ✓

$=10x-28x+20+21$ ✓

$=-18x+41$ ✓

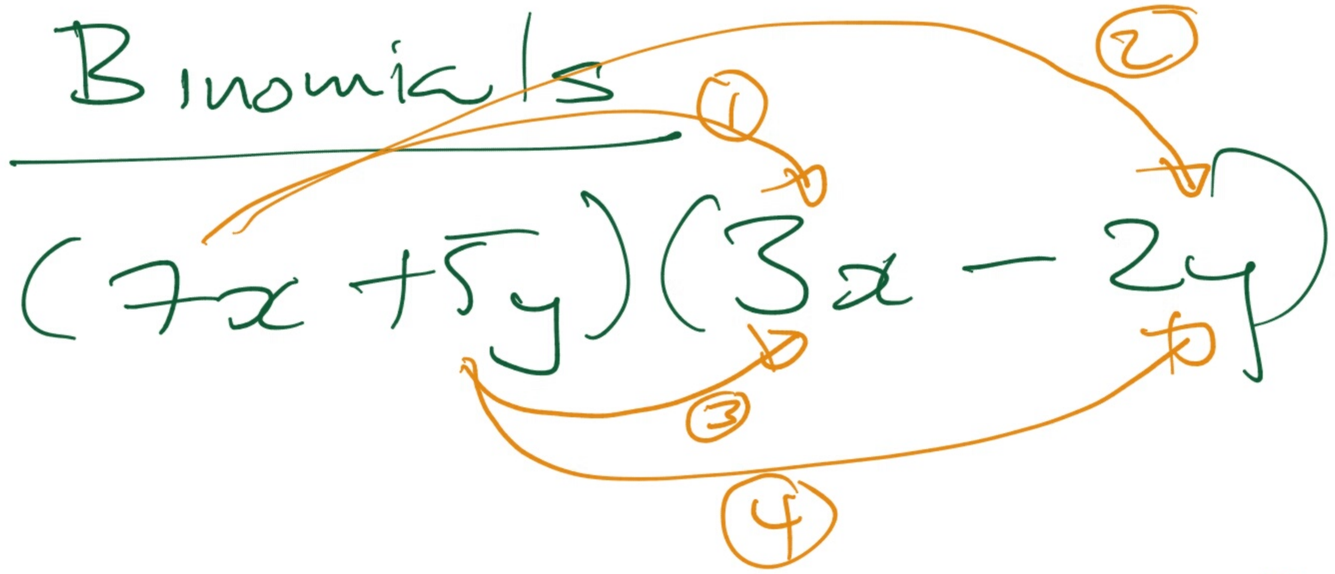
constant

~~term~~

x^2+x+1

Binomials

$(7x + 5y)(3x - 2y)$



$= 21x^2 - 14xy + 15xy + 10y^2$

$= 21x^2 + xy + 10y^2$

FOIL

F - FIRST TERMS

O - Outside

I - Inside

L - last.

* Factorization
* Quadratic Expressions

Quadratic Expressions.

$ax^2 + bx + c$

c is constant

→ Coefficient.

$x^2 + bx + c = (x+m)(x+n)$

$(x-8)(x-2)$

$= x^2 - 2x - 8x + 16$

$= x^2 - 10x + 16$

* $(x-3)(x-2)$

$= x^2 - 2x - 3x + 6$

$= x^2 - 5x + 6.$

↳ Composition.

$x^2 - 2x - 8$ ⊙

factor the following

$ax^2 + bx + c = (x+m)(x-n)$ → Decompose.

steps

① $a \times c = -8$

② add/subtract to get b

③ factor out

$x^2 - 4x + 2x - 8$

$(x^2 - 4x) + (2x - 8)$

$x(x-4) + 2(x-4)$

$(x+2)(x-4)$ *

$1x^2 - 5x + 6$

$x^2 - 3x + -2x + 6$

$(x^2 - 3x) + (-2x + 6)$

$x(x-3) - 2(x-3)$

$(x-2)(x-3)$

① $6 : 9 \times c$

② $3 \times 2 = 6$

$-3 \times -2 = 6$

$-3 + -2 = -5$

③ factorize.

$x^2 + 4x + 3$

$x^2 + 7x - 30$

$x^2 + 4x + 3$

$x^2 + 7x - 30$

$x^2 + 4x + 3$

$x^2 + 3x + 1x + 3$ ⑦

$(x^2 + 3x) + (1x + 3)$

$x(x+3) + 1(x+3)$

$(x+1)(x+3)$

① $ac = 3$

$3 \frac{1}{3}$ 1

$3 \times 1 = 3$

$3 + 1 = 4$

$x^2 + 4x + 3$

$x^2 + 7x - 30$

$x^2 + 3x - 10x - 30$

$x = -30$

$x^2 + 10x - 3x - 30$ *

$(x^2 + 10x) + (-3x - 30)$

$= x(x + 10) - 3(x + 10)$

$= (x - 3)(x + 10)$.

$2x^2 - x - 21$

$-42 = ac$

$42 \quad 1 \quad -1$

$a = 1$

$a > 1$

$2x^2 + bx - 7x - 21$

$6 + 7$

$6x - 7 = -42$

$(2x^2 + bx) + (-7x - 21)$

$6 + -7 = -1$

$2x(x+3) - 7(x+3)$

$(2x - 7)(x+3)$

$3x^2 + 11 + 10$

$(3x^2 + 6x) + (5x + 10)$

$3x(x+2) + 5(x+2)$

$(3x+5)(x+2)$ ▷

$ac = 30$

11

30

6 & 5.

$10 \div 1 = 10$

$6 \times 5 = 30$

$6 + 5 = 11$

① $a^2 - b^2 = 4 - b^2$

$= 2^2 - b^2$

term 1

$a^2 - b^2 = (a+b)(a-b)$

$= 4 - b^2 = 2^2 - b^2$

$(2+b)(2-b)$

Special Product

- 2 terms
- → square
- → cubes

$a^3 - 216$ → Condition $\sqrt[3]{216} = 6$

Binomial Cube.

$6^3 = 6 = 216$ *

$= a^3 - 6^3$

$= (a-b)^3 = a^3 + 3a^2b + 3ab^2 - b^3$ *Perfect

$= (a-b)^3 = a^3 + 3a^2b + 3ab^2 - b^3$

$= a^3 - 18a^2 + 108a - 216$.

$$3y^2 - 192$$

factorize

$$= 3(y^2 - 64)$$

$$= 3(y^2 - 8^2)$$

$$= 3(y-8)^2$$

$$= 3(y+8)(y-8)$$

Apply special product:

$\sqrt{64} = 8$

* Difference of Squares

* $a^2 - b^2 = (a+b)(a-b)$

⑤ $11y^2 - 43yz - 4z^2$

$= -1(11y^2 + 43yz + 4z^2)$

(Prefect square).

$a^2 + 2ab + b^2 = (a+b)^2$

$= -(11y^2 + 43yz + 4z^2)$

| taking out -ve sign factoring out -ve 1 or -1

Special Products

* Sta

Conditions

* Solve for unknow values.

* LHS = RHS

$$\frac{4x}{4} = \frac{40}{4}$$

$$x = 10$$

→ unknow value
subject of the formular.

BODMAS

$-2(3x-5)+3(x-1)=-5$

$-6x+10+3x-3=-5$ GRP LIKE

$-6x+3x=-5-10+3$

LHS = RHS

$\frac{-3x}{-3} = \frac{+12}{+3}$ 4

$x = 4$ D

NB

* Note your signs

* factorise

$$\frac{3}{x} = 36$$

LHS = RHS

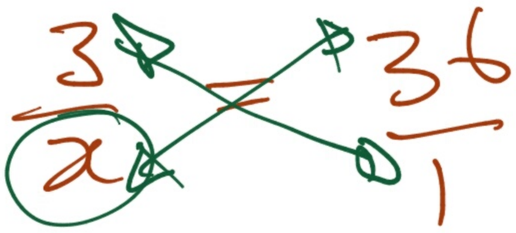
$$x \cdot \frac{3}{x} = 36x$$

$$\frac{3}{36} = \frac{36x}{36}$$

$$x = \frac{1}{12}$$

* Variable of Fraction.
* numerator (or numerator)

Cross multiplication.



$$\frac{3}{36} = \frac{36x}{36}$$

$$x = \frac{1}{12}$$

④ Pg 36

$8z - 3(2z - 3) = -4(2 - z) + 3(z - 4) - 1$

Solve for z!

$8z - 6z + 9 = -8 + 4x + 3x - x - x - 1$ → Signs

$\frac{2z}{2} = \frac{-30 + 7x}{2}$ *

$z = -15 + 3{,}5x$

$$\frac{1}{x+1} = 1 - \frac{5}{2x-4}$$

LHS = RHS

x numerators

$$\frac{(x+1)\,1}{(x+1)} = 1(x+1) - \frac{5}{2x-4}(x+1)$$

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

$$2x-4 = (x+1)(2x-4) - 5(x+1)$$

$$2x-4 = 2x^2 - 4x - 2x - 4 - 5x - 5$$

$$2x-4 = 2x^2 - 11x - 9$$

$2x - 4 = 2x^2 - 11x - 9$

$0 = 2x^2 - 11x + 2x - 9 + 4$

$0 = 2x^2 - 9x - 5$

① quadric formular

② factorization.

Quadratic

$ax^2 + bx + c = 0$

two answers

$(x+a)(x+b) = 0$

$x + a = 0$

or

$x + b = 0$

$$0 = 2x^2 - 9x - 5 \qquad -10$$

$$0 = 2x^2 + 1x - 10x - 5 \qquad -10 + 1$$

$$-10 \times 1$$

$$0 = (2x^2 + 1x) + (-10x - 5) \qquad = -10$$

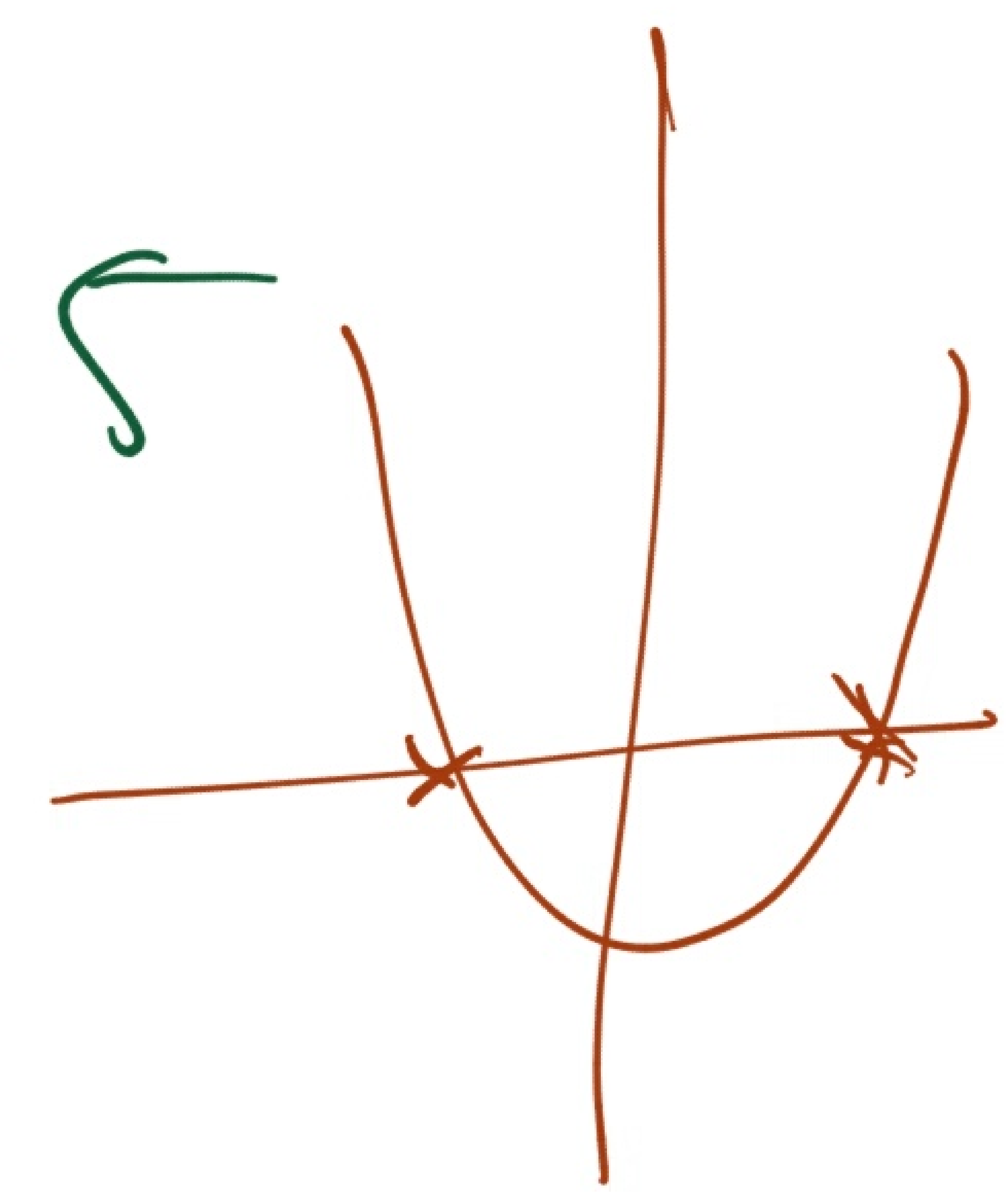
$$-10 + 1$$

$$0 = x(2x + 1) - 5(2x + 1) \qquad -9$$

$$0 = (2x + 1)(x - 5)$$

$$0 = 2x + 1 \quad \text{or} \quad 0 = x - 5$$

$$x = -\frac{1}{2} \quad \text{or} \quad x = 5$$



$$x^2 - x - 12 = 0$$

$$(x^2 - 4x) + (3x - 12) = 0$$

$$x(x-4) + 3(x-4) = 0$$

$$(x+3)(x-4) = 0$$

$$x + 3 = 0 \quad \text{or} \quad x - 4 = 0$$

$$\underline{x = -3} \quad \text{or} \quad \underline{x = 4}$$

-12

$-4 \div 3$

$-4 + 3$

$4m^2 - 1 = 0$

$2^2 m^2 - 1^2 = 0$

$(2m-1)^2 = 0$

$(2m-1)(2m+1) = 0$

$2m - 1 = 0$ or $2m + 1 = 0$

$m = \frac{1}{2}$ or $m = -\frac{1}{2}$

$(a-b)^2$

$= (a-b)(a+b)$

① $3x^2 - 2x - 8 = 0$ Solve for x

② $10x^2 + 19x + 6 = 0$ $\left(x = -\frac{2}{5} \text{ or } x = -\frac{3}{2}\right)$

$3x^2 - 2x - 8 = 0$

-24

$-6 \times 4 = -24$

$-6 + 4 = -2$

$(3x^2 - 6x) + (4x - 8) = 0$

$3x(x-2) + 4(x-2) = 0$

$(3x+4)(x-2) = 0$

$3x + 4 = 0$ or $x - 2 = 0$

$x = -4/3$ $x = 2$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$2x^2 - 3x - 2 = 0$

a b c

$$x = \frac{-(-3) \pm \sqrt{-3^2 - 4(2)(-2)}}{2(2)}$$

$$x = \frac{3 \pm \sqrt{9 + 16}}{4}$$

$ax^2 + bx = c$

-4

-4×1

$-4 + 1$

$2x^2 + 11x + 13$

Prime numbers

-3×-3

$$x = \frac{3 \pm \sqrt{9+16}}{4}$$

$$x = \frac{3 \pm \sqrt{25}}{4}$$

$$x = \frac{3+5}{4} \quad \text{or} \quad x = \frac{3-5}{4}$$

$$x = 2 \quad \text{or} \quad x = -\frac{2}{4} = -\frac{1}{2}$$

$$x^2 - 2x - 143 = 0$$

$$\frac{-(-2) \pm \sqrt{-2^2 - 4(1)(-143)}}{2(1)}$$

$$\frac{2 \pm \sqrt{4 - (-572)}}{2}$$

$$\frac{2 \pm \sqrt{576}}{2}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{2 + \sqrt{576}}{2} \quad \text{or} \quad \frac{2 - \sqrt{576}}{2}$$

$$\frac{2+24}{2} \quad \text{or} \quad \frac{2-24}{2}$$

$$x = \frac{26}{2} \quad \text{or} \quad x = \frac{22}{2}$$

$$x = 13 \quad \text{or} \quad x = 11$$

Solve using Quadratic formula

↓

① $4x^2 = -15x - 4$

② $6x^2 + 29x = 5$

① $4x^2 + 15x + 4 = 0$ ✓

$$x = \frac{-15 \pm \sqrt{15^2 - (4)(4)(4)}}{8}$$ ✓

$$x = \frac{-15 \pm \sqrt{161}}{8}$$ ✓

$x = -0,29$ or $x = -3,46$ ✓

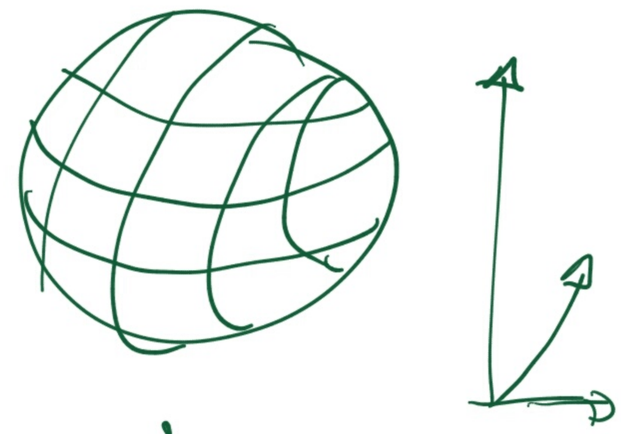
Coordinate Geometry

Coordinates.

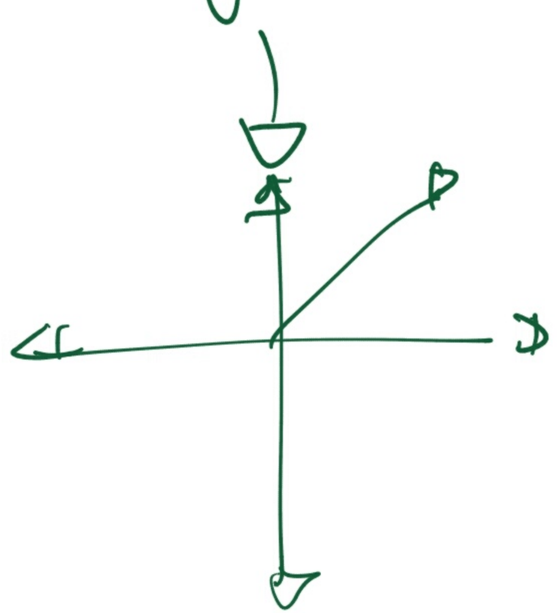
* Shapes
* Calculate.

* DMS (Long: Latitude)-
* (x; y)

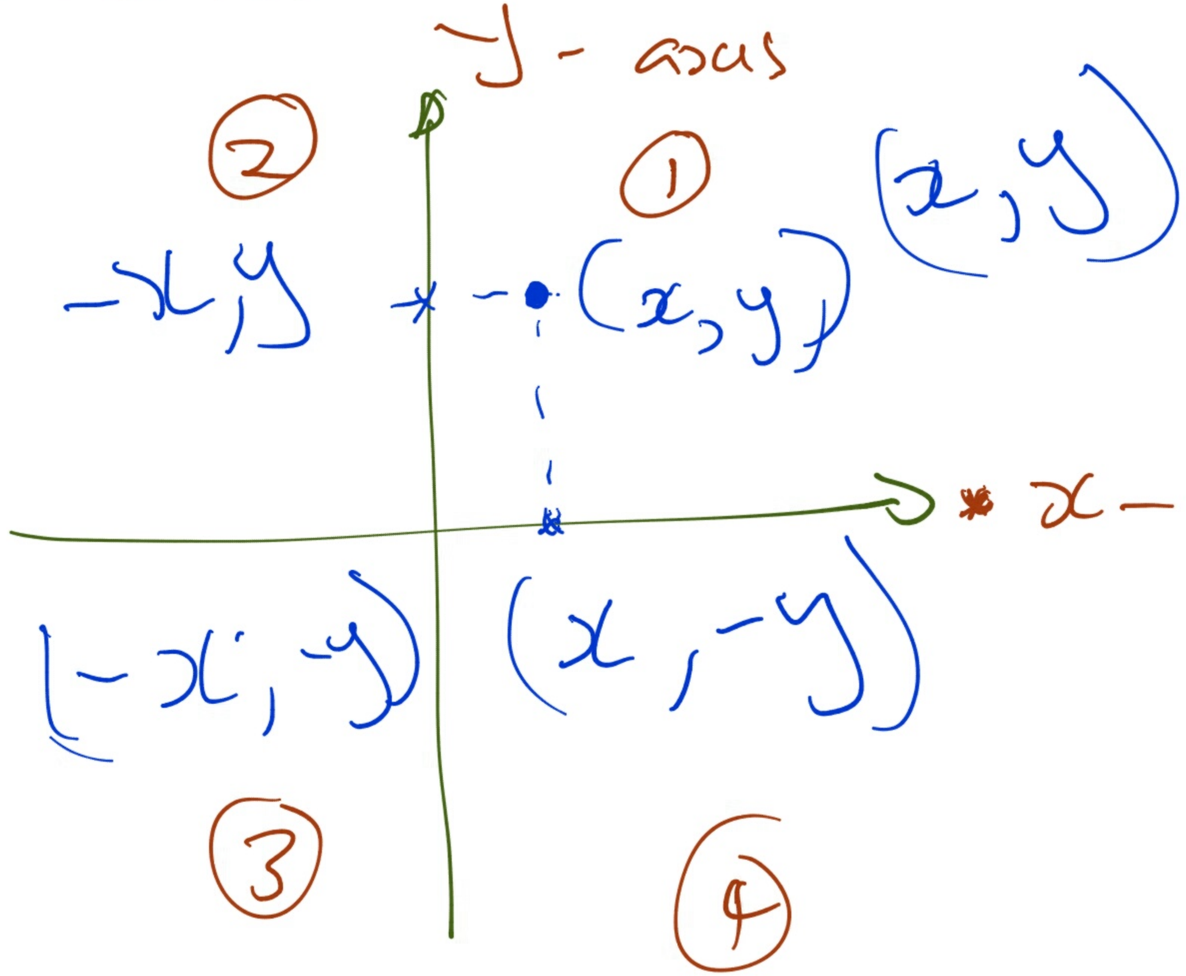
* Analysis → measuring/Calc
→ Project Data (x, y)
Units (meters.) (x: y, z)

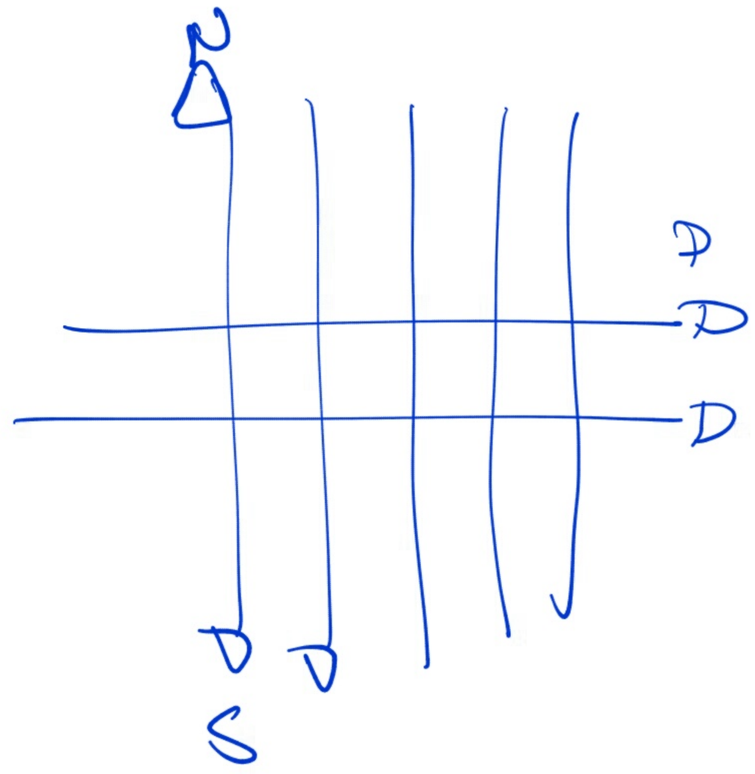


Project



Cartesian Plane.





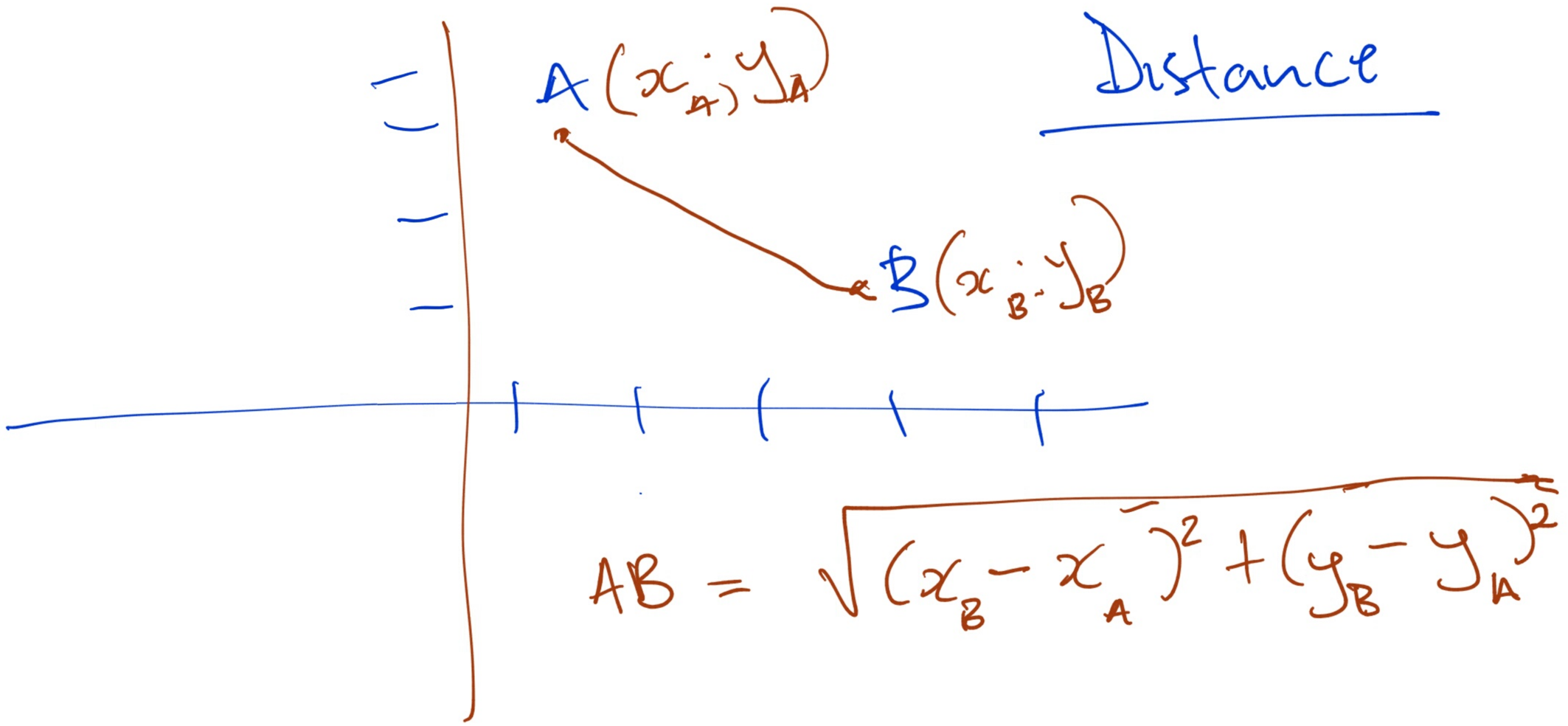
Calc

* Distance ① Ind
* Angles ②
* Direction ③
* Area ...

Topic:

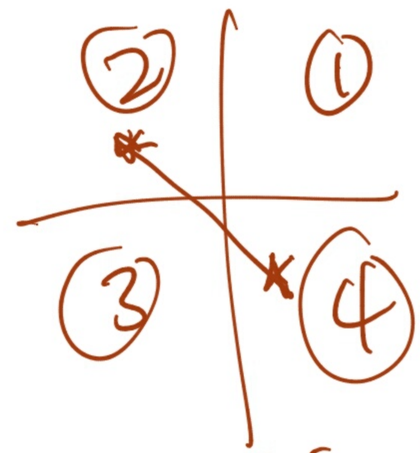
* functions / Graphs
* Trigonometry
* Set Theory
* Calculus

Distance



$$AB = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$$

$A(-3,5)$ & $B(5,-10)$



$$AB = \sqrt{(5-(-3))^2 + (-10-5)^2}$$

$$= \sqrt{8^2 + (-15)^2}$$

$$= \sqrt{64 + 225}$$

$$= \sqrt{289}$$

$$= 17 \text{ units}$$

Units SI

meter

$$AB = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$

$$\sqrt{64} + \sqrt{225}$$

$$8 + 15$$

$$23$$

Midpoint

* Coordinate:

A ; B

* $M_{AB} = \left(\frac{x_A + x_B}{2} ; \frac{y_A + y_B}{2} \right)$

Interval

Ratio

$K = 1$

$A(-3;5)$; $B(5;-10)$

$\left(\frac{-3+5}{2} ; \frac{5+-10}{2} \right) = \frac{2}{2} ; \frac{-5}{2}$

$= (1; 2,5)$

$$x = \frac{x_A + kx_B}{1+k} \rightarrow \text{Ratio}$$

$2 : 5$

$\frac{2}{5}$ (7)

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

$$x = \frac{-15 + 10}{7}$$

$$x = -\frac{5}{7}$$

coordinate (x value).

(no ERROR.)

2 : 5

A — B

2 :

$A(-3;5)$ $B(5;-10)$

$A(-3,-7)$, $B(-1;-4)$

$4:3$

$$\frac{x_A + k x_B}{1+k}$$

$$k = \frac{4}{3}$$

$$x = \frac{-3 + \left(\frac{4}{3}\right)(-1)}{1 + \frac{4}{3}}$$

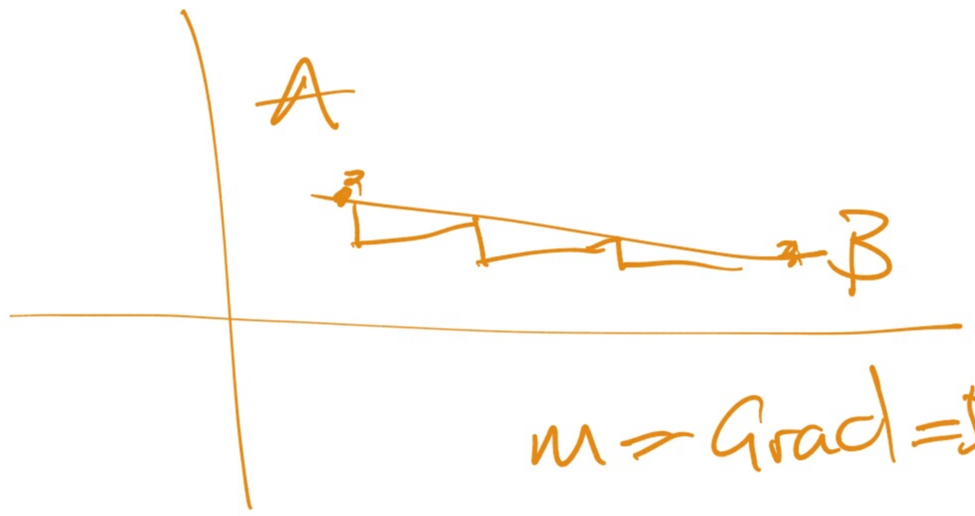
$$x = \frac{-3 - \frac{4}{3}}{1 + 1\frac{1}{3}}$$

$$x = \frac{\frac{-3}{1} - \frac{4}{3}}{\frac{1}{1} + \frac{4}{3}}$$

$$x = \frac{\frac{-9-4}{3}}{\frac{3+4}{3}}$$

$$= -\frac{13}{3} \times \frac{3}{7} = \frac{-13}{7}$$

$$m = \frac{\Delta y}{\Delta x}$$



m = Grad = Draisc

$$= \frac{y_B - y_A}{x_B - x_A}$$

Ratio

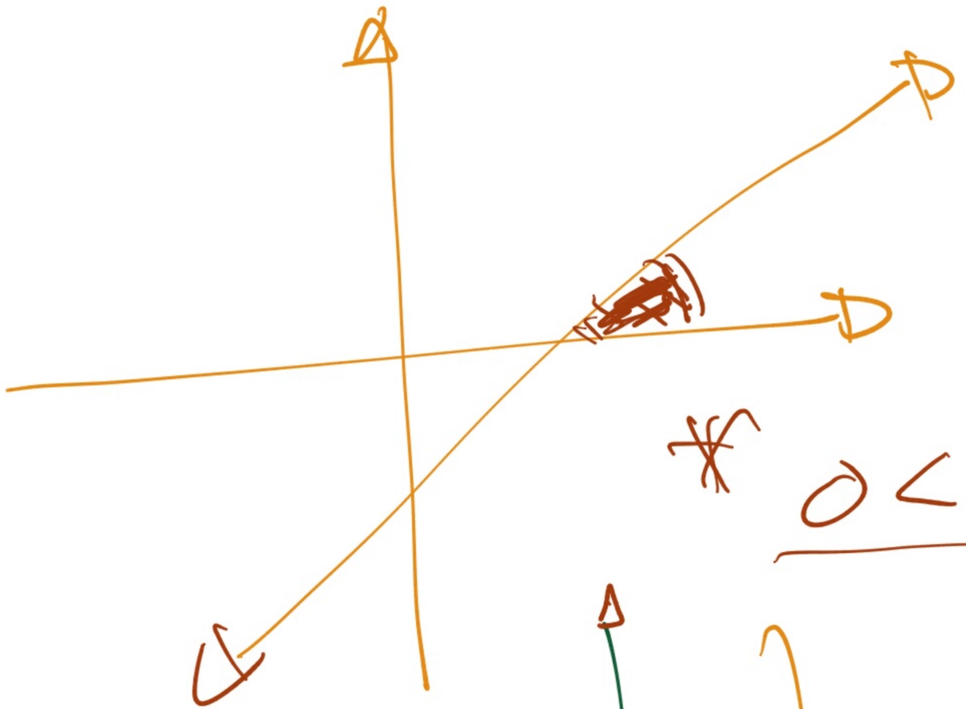
$x : y$

$A(-3 ; -7)$, $B(-1 ; -4)$

* Eucl

$$m = \frac{-4 - (-7)}{-1 ; -(-3)}$$

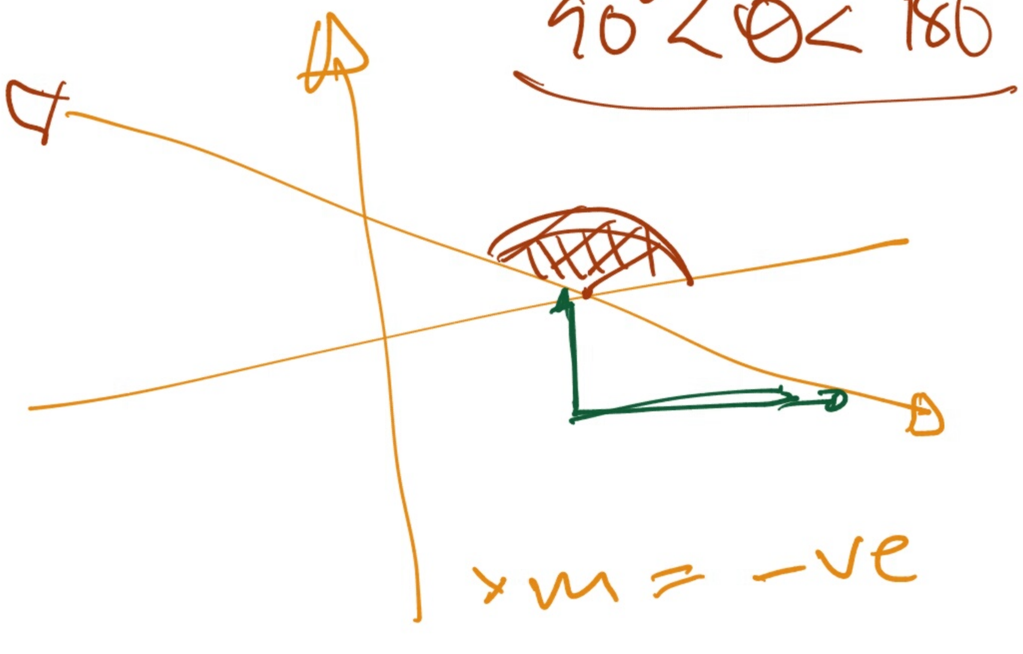
$$= \frac{-4 + 7}{-1 + 3} = \frac{3}{2}$$



$m > 0$

$m = +ve$

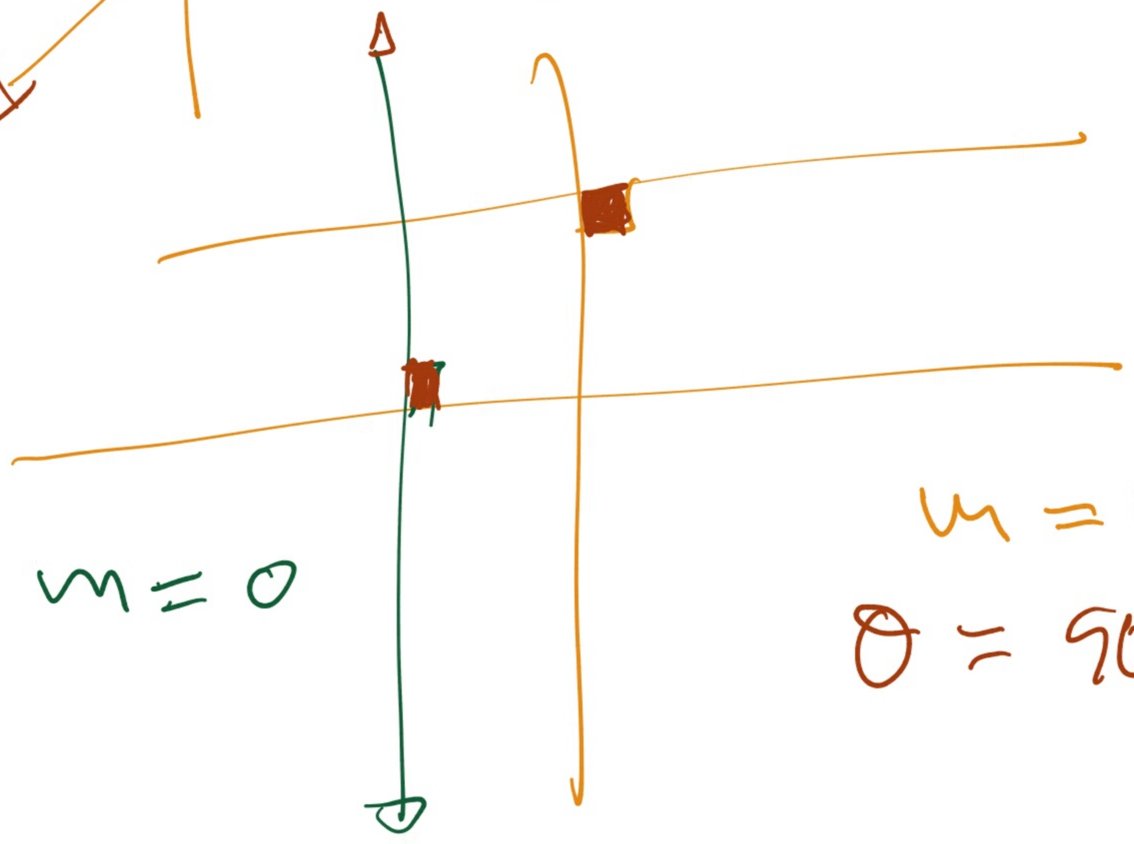
$0 < \theta < 90^\circ$



$90^\circ < \theta < 180^\circ$

$m = -ve$

$+m < 0$



$m = 0$

$m = 0$

$\theta = 90^\circ$

m

① (2, 3) & (5, 3)

→ GRADIENT

→ Distance.

→ MID POINT

② (1, 2) & (7, 8)

$m = \frac{\Delta y}{\Delta x}$

$= \frac{3-3}{5-2}$

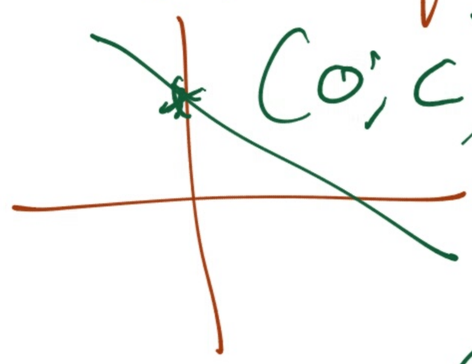
$= \frac{0}{3}$

$= 0$

Straight line

Equation of a straight line

$$m = \frac{y_B - y_A}{x_B - x_A}$$



* model a line given a single point
* Predict other Points

$$m(x_B - x_A) = y_B - y_A$$ (a) ✓

Point-Gradient - form

$y = mx + c$ ✓ (b) c = Point of intercept

gradient - intercept form $c = y$

Equation of (3;4) gradient 5

$y = mx + c$

$4 = 5(3) + c$

$4 = 15 + c$

$c = -11$

$y = 5x - 11$

Find c

(a) $m\Delta x = \Delta y$

(b) $y = mx + c$

x	1	2	3	4	5	6
y	-6	-1				

(1, -6) (2, -1)

$y = 5(1) - 11 = -6$

$y = 5(2) - 11 = -1$

Equation of line (3,4) & (−2,−3)

$m(x_B - x_A) = y_B - y_A$

$m = \frac{-3-4}{-2-3} = \frac{-7}{-5}$

$= \frac{7}{5}$

① $m = \frac{\Delta y}{\Delta x}$

② Apply form

$\frac{7}{5}(x_B - 3) = y_B - 4$

$\frac{7}{5}x_B - \frac{21}{5} + \frac{4}{1} = y$

$$\frac{7}{5}x_B - \frac{21}{5} + \frac{4}{1} = y$$

$$\frac{7}{5}x_B - 4\frac{1}{5} + 4 = y$$

$$5 * \frac{7}{5}x - \frac{1xy}{5} = y \times 5$$

$$7x - 1 = 5y$$

$$\underline{7x - 5y - 1 = 0} \quad \text{(General form).}$$

General Form $ax+by+c=0$

Point-grad form $y_B - y_A = m(x_B - x_A)$

Gradient Int $y = mx+c$

Questions

1) $(-4;4)$ & $(5,-1)$

2) $(2,4)$ gradient 3

$y = mx+c$

$4 = (3)2 + c$

$4 = 6 + c$

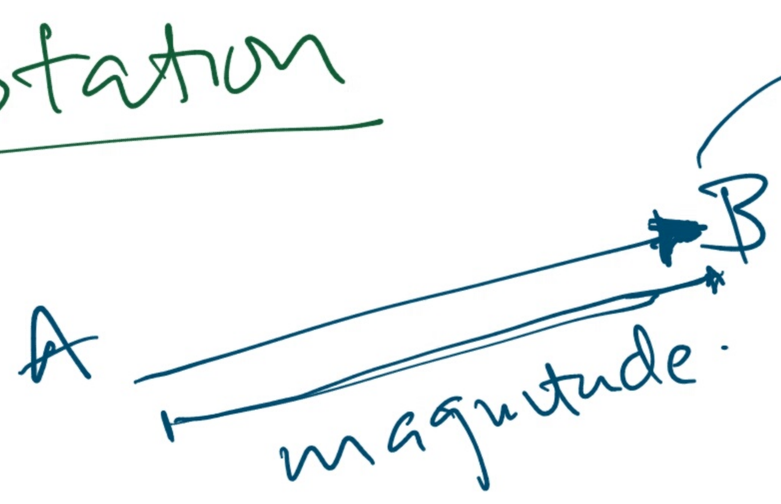
$c = -2$

$y = 3x - 2$

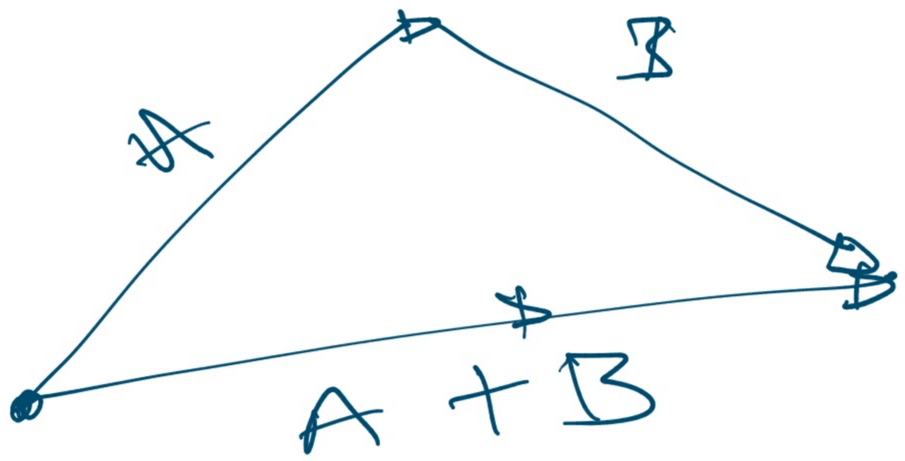
Vector (Maths)

* quantifiers
* Show magnitude à Direction.
  → Displacement

Notation



* $|\overrightarrow{AB}|$ * notation
* $\overrightarrow{CD}$
* Vector units
  $|\hat{a}| = 5$



Resultant is given.

→ Tail to head.

→ Velocity.

→ Force.

→ Physics

FuncAtions

* Application → Pair variable
* Domains → (Independent variable)
* Ranges → (Dependent)

→ (Dependent)

x (independent)

y

(x; y)

= f(x) = what is the function of x

→ Time

→ Temp

$f(x) = \}$
$g(x) = \}$ Range value.

* Depends on domain
* Use (Equation).

Evaluate $f(a)$

* dependant variable
* Condition.

f

* Memo to manual Questions. / weekly
* Past papers :- links / memo
* 9s Maths Book.
* Formular sheet.
* Send The Slides. / Recordings.

Evaluate $f(x) = 3x^2 - 4x + 2$

where $x = 3$ or $f(3)$

$f(3) = 3(3)^2 - 4(3) + 2$

$= 27 - 12 + 2$

$= 15 + 2$

$f(3) = 17$

$y = 17$

* at "point" 3

$f(x) = 3x^2 - 4x + 5$

is 17 ⟹

Ex $h(x+1) \neq h(x) = x + \frac{1}{x}$

$$h(x) = x+1 + \frac{1}{x+1}$$