Subject: Conics chapter (6) -2 Date:

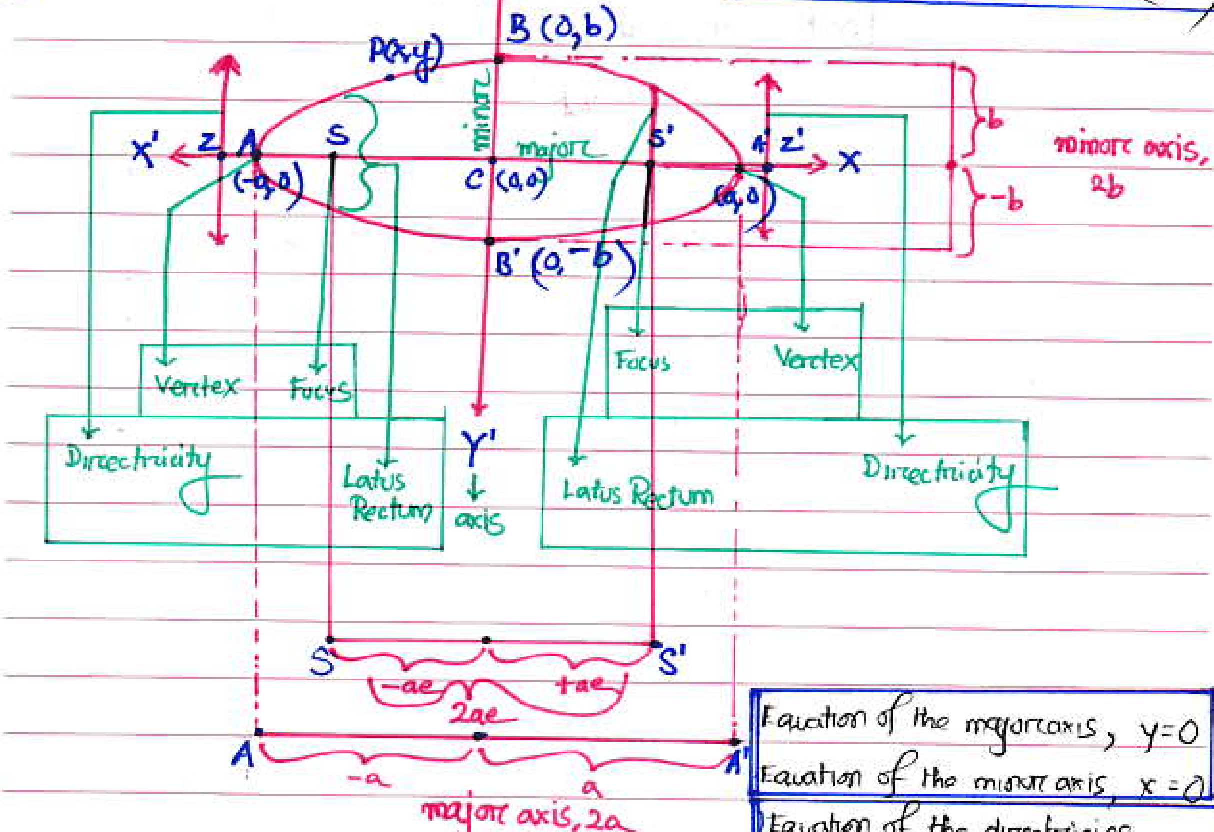
Ellipse

Type: $a>b$ Ellipse

CSA

- Length of major axis $= 2a$
- Length of minor axis $= 2b$
- Length of Latus Rectum $= 2b^2/a$

- Coordinates of center, $C \equiv (0,0)$
- Coordinates of Focus, $S \equiv (\pm ae, 0)$
- Coordinates of Vertex, $A \equiv (\pm a, 0)$



- Equation of the major axis, $y = 0$
- Equation of the minor axis, $x = 0$
- Equation of the directricies, $x = \pm \frac{a}{e}$
- Equation of the latus Rectum, $x = \pm ae$

e

Eccentricity, $e = \sqrt{\frac{a^2 - b^2}{a^2}} = \sqrt{1 - \frac{b^2}{a^2}}$

NB: For type $a<b$ Ellipse,
a এর জায়গায় b, b এর জায়গায় a,
x এর জায়গায় y, x coordinate এর বিনিময় y coordinates কে
বসালেই হবে।

Subject : (-1) Date :

Ellipse Formulas

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

$$\frac{(x-\alpha)^2}{a^2}+\frac{(y-\beta)^2}{b^2}=1$$ [α, β is the center co-ord]

$$(x-\alpha)^2+(y-\beta)^2=e^2\left(\frac{ax+by+c}{\pm\sqrt{a^2+b^2}}\right)^2$$

[α, β is the focus co-ord]

Subject : Basic Formula's ① Date :

Algebric

Square

1. $(a+b)^2 = a^2+2ab+b^2$
2. $(a+b)^2 = (a-b)^2 + 4ab$
3. $(a-b)^2 = a^2-2ab+b^2$
4. $(a-b)^2 = (a+b)^2 - 4ab$
5. $(a^2+b^2) = \frac{(a+b)^2+(a-b)^2}{2}$
6. $2(a^2+b^2) = (a+b)^2+(a-b)^2$
7. $(a^2-b^2) = (a+b)(a-b)$
8. $(a+b)^2-(a-b)^2 = 4ab$

Cube

10. $(a+b)^3 = a^3+b^3+3ab(a+b)$
11. $(a+b)^3 = a^3+3a^2b+3ab^2+b^3$
12. $(a-b)^3 = a^3-b^3-3ab(a-b)$
13. $(a-b)^3 = a^3-3a^2b+3ab^2-b^3$
14. $a^3-b^3 = (a-b)(a^2+ab+b^2) = (a-b)^3+3ab(a-b)$
15. $a^3+b^3 = (a+b)(a^2-ab+b^2) = (a+b)^3-3ab(a+b)$

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

Triple axe

9. $(a+b+c)^2 = a^2+b^2+c^2+2ab+2bc+2ca$

9. $(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$

Important

16. $(a+b+c)^3 = a^3+b^3+c^3+3a^2b+3ab^2+3a^2c+3b^2c+3bc^2+3c^2a+6abc$

Quadratic

ax^2+bx+c

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

$a^3+b^3+c^3-3abc = (a+b+c)(a^2+b^2+c^2-ab-bc-ca)$
$= (a+b+c)\{a^2+b^2+c^2-(ab+bc+ca)\}$
$= (a+b+c)\{a^2+b^2+c^2+2(ab+bc+ca) - 3(ab+bc+ca)\}$
[redacted]
$= (a+b+c)\{(a+b+c)^2 - 3(ab+bc+ca)\}$

***** Chapter 4 & 5

$a^2+b^2+c^2-ab-bc-ca = \frac{1}{2}\{(a-b)^2+(b-c)^2+(c-a)^2\}$
$= (a+b+c)^2 - 3(ab+bc+ca)$

chapter 4 : polynomial ②

minimum maximum value

Quadratic Equation

minimum when in a quadratic equation $a > 0$ 

maximum when in a quadratic equation $a < 0$. 

Calculator এর quadratic answer এ high magnitude value টাই constant value.

$\pm ax^2 \pm bx \pm c$

~~if $a > 0$, or a is positive~~,

$\{ ax$ (low magnitude value dripped in a eq^n) $\}$ + (high magnitude value)

positive/ Negative per equation

positive/ Negative per calculator

Positive/ Negative per calculator.

$$\text{Vertex} : \left(-\frac{b}{2a} , f\left(-\frac{b}{2a}\right) \right)$$

Subject : Date :

Example 1

$5u^2 + 8u - 2$

① calculator minimum values $-4/5$ or -0.8 (low magnitude) $= 0.8$
and $-26/5$ or -5.2 (high magnitude) $= 5.2$

② a is 5 and greater than zero. a is positive. $a = 5$

③ The equation:

$$\{a \times (\text{low magnitude w/ } x)^2\} + (\text{high magnitude})$$

$$= \left\{5 \times \left(x - -\frac{4}{5}\right)^2\right\} + \left(-\frac{26}{5}\right)$$

$$= \{5 \times (5u+4)^2\} - \left(\frac{26}{5}\right)$$

$$= 5\left(x + \frac{4}{5}\right)^2 - \frac{26}{5}$$

$$= 5\left(x + \frac{4}{5}\right)^2 - \frac{26}{5}$$

Subject : Date :

4

Example 2

$4 - 5x - 2x^2$

or, $-2x^2 - 5x + 4$

$\to$ Max

① Calculator : $-5/4$ or, -1.25 (low magnitude)

$57/8$ or, 7.125 (high magnitude)

② $a < 0$ or a is negative $a = -2$

③ Equation

$\left\{a \times \left(\text{low magnitude w/ } x\right)^2\right\} + \left(\text{high magnitude}\right)$

$= \left\{-2 \times \left(x = -5/4\right)^2\right\} + \left(57/8\right)$

$= \left\{-2 \times \left(4x+5\right)^2\right\} + \left(57/8\right)$

$= -2\left(x + \frac{5}{4}\right)^2 + \frac{57}{8}$ directly

HEART'S

- Complex = $(x + iy) = z$

Conjugate

- Complex = $(x - iy) = \bar{z}$

x = real part

y = conjugate part

(1)

- $i = \sqrt{-1}$
- $i^2 = -1$
- $i^3 = -i$
- $i^4 = 1$

$\sqrt{-1} \rightarrow -1 \rightarrow -i \rightarrow 1$

$(x, y) \rightleftharpoons (r, \theta)$

if $z = x + iy$, then modulus, r is

- $r = \sqrt{x^2 + y^2} = |z|$

Polar Form:

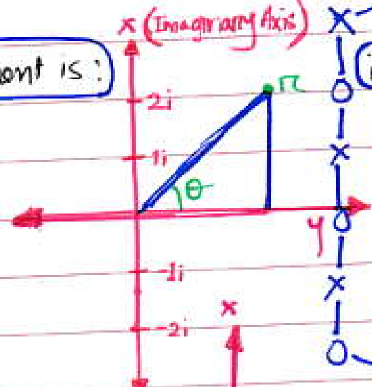
- $r(\cos\theta + i\sin\theta) = re^{+i\theta}$

(2) if $z = x \pm iy$ then argument is:

- $\theta = \tan^{-1}\left(\frac{y}{x}\right)$

1st Quadrant

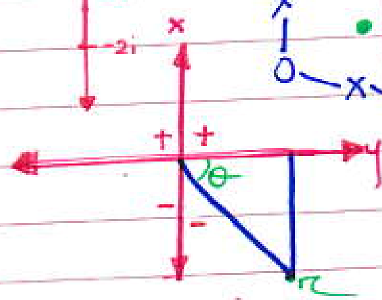
+



- $\theta = -\tan^{-1}\left(\frac{y}{x}\right)$

4th Quadrant

−



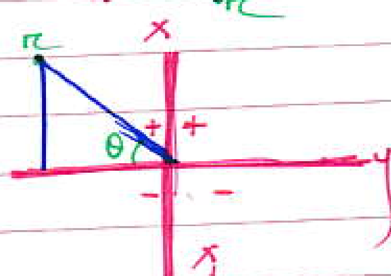
θ = Argument

r = Absolute value or modulus

- $\theta = \pi - \tan^{-1}\left(\frac{y}{x}\right)$

2nd Quadrant

+

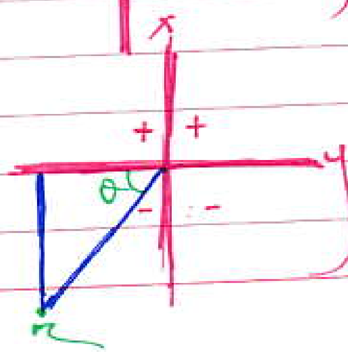


$-(\ldots)$

- $\theta = -\pi + \tan^{-1}\left(\frac{y}{x}\right)$

3rd Quadrant

−



HEART'S

Subject : Date :

3 Quadratic Equation $\boxed{: \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}}$

4 $\text{Modulus}^2 = |z|^2 = z\bar{z} = (x+iy)(x-iy) = x^2+y^2 = r^2$

$\therefore |z| = r = \sqrt{x^2+y^2}$

$\therefore |z|^2 = z\bar{z}$

1	2	3	4
$\sqrt{-1} \rightarrow$	$-1 \rightarrow$	$-i \rightarrow$	1
i	i^2	i^3	i^4

5 $(-1) \rightleftharpoons i^2 \rightleftharpoons (\omega+\omega^2)$

$1 \rightleftharpoons i^4 \rightleftharpoons -i^2 \rightleftharpoons \omega^3$

6 $\boxed{(1+\omega+\omega^2) = 0.}$

$\boxed{\omega^3 = 1}$

$\boxed{\omega = \dfrac{1}{\omega^2}}$ & $\boxed{\omega^2 = \dfrac{1}{\omega}}$

$\boxed{e^{-i\theta} = \cos\theta - i\sin\theta}$

$re^{-i\theta} = r(\cos\theta - i\sin\theta)$

$re^{i\theta} = r(\cos\theta + i\sin\theta)$ → Polar Form

7 Complex roots of cubes are $1, \omega, \& \omega^2$

if one of them is $\boxed{\frac{1}{2}\sqrt{-1-\sqrt{-3}}}$ others will be $\boxed{-\frac{1}{2}\sqrt{-1+\sqrt{-3}}}$

Subject: **Finding Square Root of a complex number by calculator.**

Date:

(2)

$$-7 + 24i \qquad [\,a + bi\,]$$

$$= \sqrt{-7 + 24i} \qquad \left[\sqrt{a + bi}\,\right]$$

$$= 25\angle 106.2602047 \qquad [\,\text{calculator } r\angle\theta\,]$$

$$= \sqrt{25} \cdot \frac{\angle 106.2602047}{2} \qquad \left[\sqrt{r} \cdot \frac{\angle\theta}{2}\right]$$

$$= 5 \cdot \angle 53.13010235 \qquad [\,r_1 \cdot \angle\theta_1\,]$$

$$= \pm(3 + 4i) \qquad [\,r_1 \angle\theta_1 \rightarrow a_1 + b_1 i\,]$$

Subject : Probability

And → ×

OR → +

⑥ A bag having 11 balls : 5 black . 6 white . 2 balls are taken/drawn

① Probability of getting two black balls = $\cancel{{}^5C_2 / {}^{11}C_2}$

② " " two white balls = $\cancel{{}^6C_2 / {}^{11}C_2}$

③ " " " one black and one white = $\frac{{}^5C_1 \times {}^6C_1}{{}^{11}C_2}$

④ Two black or Two white = $\frac{{}^5C_2 + {}^6C_2}{{}^{11}C_2}$

⑦ ⓐ or ① 6 numbers just we're taking 4 balls. 2 white , 2 black from 11.

" " " Two black and Two white = $\frac{{}^5C_2 \times {}^6C_2}{{}^{11}C_4}$

⑦ (iii) $\boxed{\text{ML2 Bhaia}}$

Subject :

Date :

8 ~~Two different boxes~~ A box having two different types of color marbele's, 6 White and 5 Black. How Two marbels are taken. Total marbel = 6+5 = 11

1. Same color → (Both White) or (Both Black)

$$= \left(\frac{6}{11} \times \frac{5}{10}\right) + \left(\frac{5}{11} \times \frac{4}{10}\right)$$

6 (4) from here.

2. Different color → (1st White and 2nd Black) or (1st Black and 2nd White)

$$= \left(\frac{6}{11} \times \frac{5}{10}\right) + \left(\frac{5}{11} \times \frac{6}{10}\right)$$

6 (3) from here

3. Not all White → 1 − (Both are White)

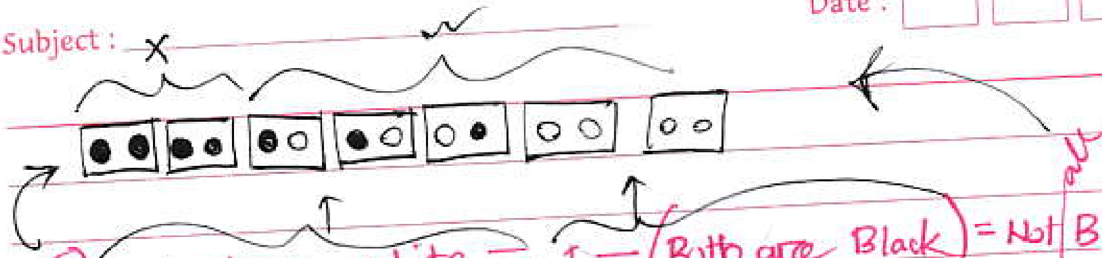
$$= 1 - \left(\frac{6}{11} \times \frac{5}{10}\right)$$

4. Not all Black → 1 − (Both are Black)

$$= 1 - \left(\frac{5}{11} \times \frac{4}{10}\right)$$

HEART'S

Subject : Date :



⑤ At least one white = 1 − (Both are Black) = Not all Black

$= 1 - \left(\frac{5}{11} \times \frac{4}{10}\right)$ ~~= 1 − 1 − (6/11 × 5/10)~~

⑥ At least one Black = 1 − (Both are White) = Not all White

$1 - \left(\frac{6}{11} \times \frac{5}{10}\right)$

8 Again

Two boxes having two diff. colored marbles. White and Black.

Now we take one marble from each box

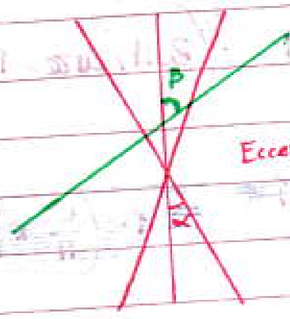
① Same color = (1st box white and 2nd box white) or, (1st box black and 2nd box black)

② Different color = (1st box white & 2nd box black) or, (1st box black & 2nd box white)

③ At least one white = 1 − (Both are Black) = 1 − (1st box white & 2nd box White)

④ At least one Black = 1 − (Both are white) = 1 − (1st box white & 2nd box white)

HEART'S



$$\text{Eccentricity} = \frac{\sin(\text{angle of plane})}{\sin(\text{angle of cone slant})}$$

$$= \frac{\sin\beta}{\sin\alpha}$$

$2a/e$

Coordinates of center, $C \equiv (0,0)$

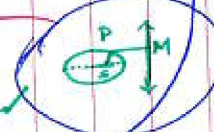
Coordinates of Focus, $S \equiv (\pm ae, 0)$

Coordinates of Vertex, $A \equiv (\pm a, 0)$

CSA

Also $P \equiv (x, y)$

- Ellipse Equation: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- When center is (α, β),
  Ellipse Equation: $\frac{(x-\alpha)^2}{a^2} + \frac{(y-\beta)^2}{b^2} = 1$
- When Focus is (γ, δ),
  Ellipse Equation: $(x-\gamma)^2 + (y-\delta)^2 = e^2 \left| \frac{ax+by+c}{\pm\sqrt{a^2+b^2}} \right|^2$



Def^n of Ellipse: $SP = e \cdot PM$

Length of major axis $= 2a$

Length of minor axis $= 2b$

Length of Latus Rectum $= \frac{2b^2}{a}$

- Eccentricity: $\sqrt{\frac{a^2-b^2}{a^2}} = \sqrt{1-\frac{b^2}{a^2}}$

Equation of major axis: $\boxed{y=0}$

Equation of minor axis: $\boxed{x=0}$

Equation of Latus Rectum: $\boxed{x = \pm ae}$

Equation of Directrices: $\boxed{x = \pm \frac{a}{e}}$

- Distance bet^n two directrix is $2a/e$

- Distance of two Vertices (A and A') $= 2a$
- Distance of two Focus (S and S') $= 2ae$
- Distance between Focus and Directrix (S and Z or S' and Z') $= a/e - ae$

For $b > a$ Ellipse,

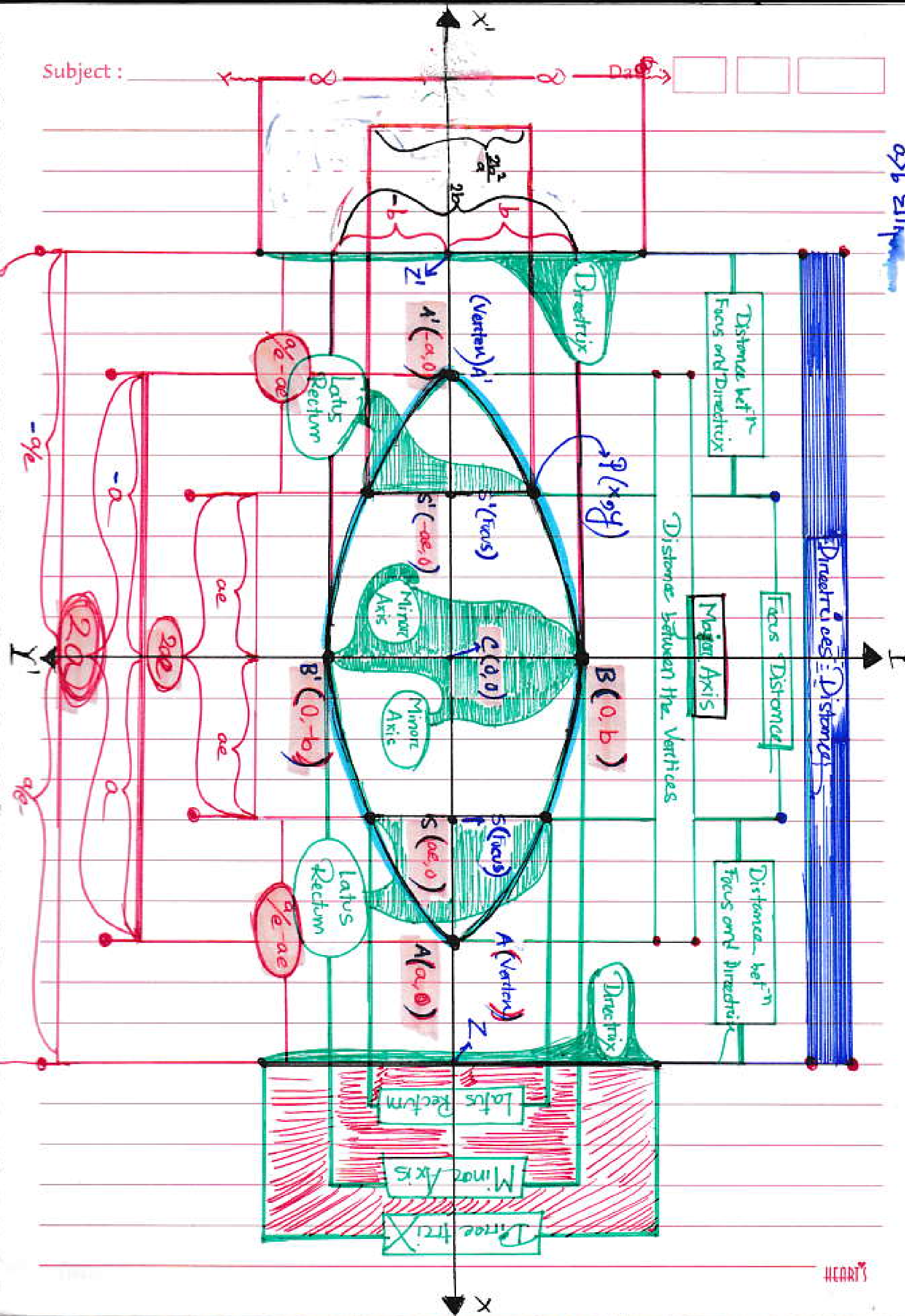
① a replaced to b, ② b replaced to a.

③ x coordinates to y coordinates.

④ y coordinates to x coordinates.

Easy

Subject : Date



Subject : Parabola ①

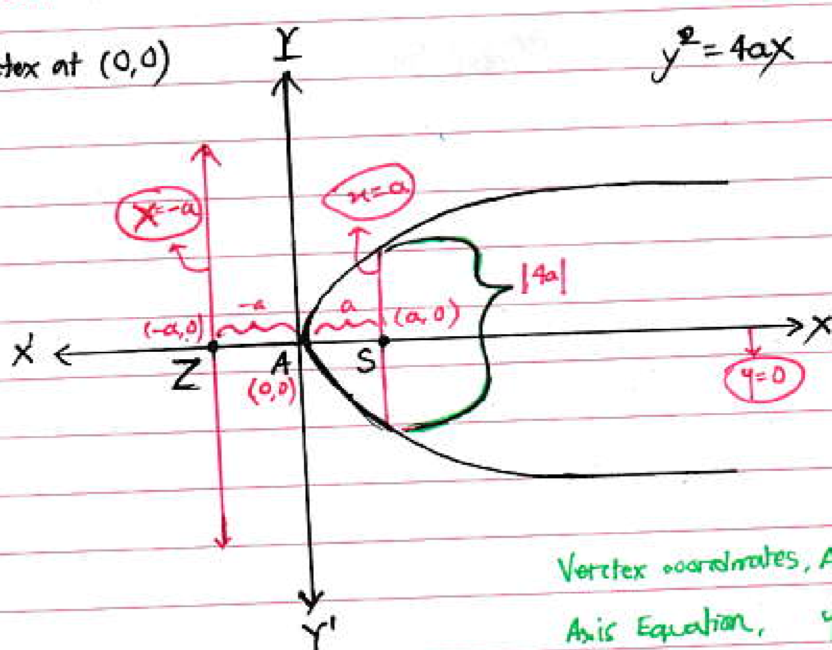
Date :

Vertex and Focus on same line Parabola

• When Vertex at $(0,0)$

$y^2 = 4ax$

$*ZA = AS$

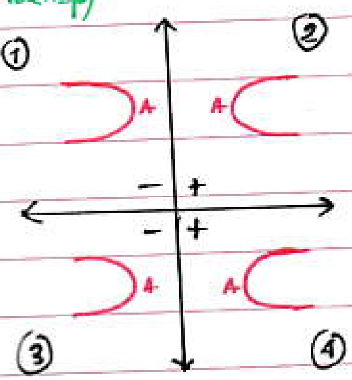


Vertex coordinates, $A \equiv (0,0)$

Axis Equation, $y=0$

• When Vertex at (α,β)

$(y \pm \alpha)^2 = \pm 4a(x \pm \beta)$



Focus coordinates, $S \equiv (a,0)$

Latus Rectum Equation, $x=a$

Latus Rectum Length, $|4a|$

Directrix point, $Z \equiv (-a,0)$

Directrix equation, $x=-a$.

$y^2 = 4ax$

① $A \equiv (-\alpha,\beta)$	② $A \equiv (\alpha,\beta)$	③ $A \equiv (-\alpha,-\beta)$	④ $A \equiv (\alpha,-\beta)$
$(y+\alpha)^2 = -4a(x-\beta)$	$(y-\alpha)^2 = 4a(x-\beta)$	$(y+\alpha)^2 = -4a(x+\beta)$	$(y-\alpha)^2 = 4a(x+\beta)$
−	+	−	+

Subject : Transformation

Date :

Parabola ① and parabola ②

① Eqn parabola ① ⇒ $y^2 = 4ax$

② Noted

③ Parabola ② → x axis এর জায়গায় y axis

x axis ⇌ y axis

x এর জায়গায় y

④ Eqn Parabola ② ⇒ $x^2 = 4ay$

⑤ Latus Rectum Length same!

Ellipse a>b and Ellipse b>a

① Ellipse a>b and b>a same equation!

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

② Ellipse a>b noted

③ Ellipse b>a ; x axis ⇌ y axis

a ⇌ b

x ⇌ y

④ Both area same!

Hyperbola ① and Hyperbola ②

- Hyperbola 1 ⇌ a>b Ellipse

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Transverse axis ⇌ Major Axis
Conjugate axis ⇌ Minor Axis

- Hyperbola 2 ⇌ b>a Ellipse

$$\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$$

Transverse Axis ⇌ Major Axis
Conjugate Axis ⇌ Minor Axis

$+ \rightleftharpoons -$

$x \rightleftharpoons y$

$a \rightleftharpoons b$

x axis ⇌ y axis.

- Equation of Asymptotes are same.

$$y = \pm \frac{bx}{a}$$

Subject : Polynomial Note Quarantin

polynomial is a perfect square

Date :

$D=0$, roots are real & equal

$D>0$, roots are real and unequal

$D<0$, roots are complex and its conjugate

$D>0$ and a perfect square, also a, b, c being rational = roots are rational, real, unequal

① $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Here discriminant is $b^2 - 4ac$ or, D

② Determination of Lowest Value and Highest Value

$$P(x) = -2x^2 + 8x + 15 = -2(x^2 - 4x + 4) + 23$$
$$= -2(x-2)^2 + 23$$

0 +

নিচের দিকে graph যাচ্ছে

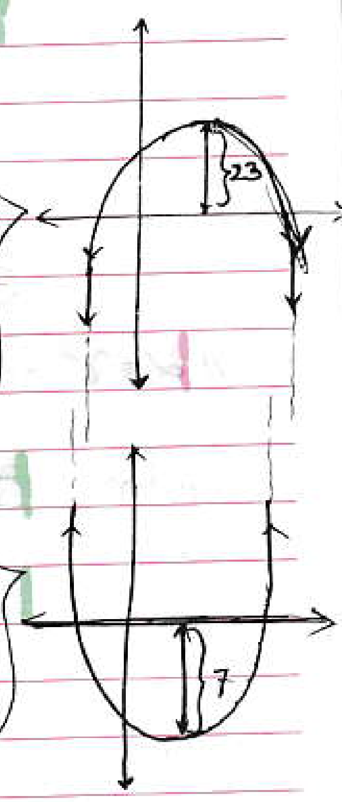
Maximum/ Highest Value

$$P(x) = 2x^2 - 8x + 15 = 2(x^2 - 4x + 4) + 7$$

+

উপরের দিকে graph যাচ্ছে

Minimum/ Lowest Value



HEART'S

Subject :

Date :

In an equation of degree n, the maximum number of roots is n.

α, β → Two roots in the equation

Equation: $x^2-(\alpha+\beta)x+\alpha\beta=0$

or, $x^2-(\text{Addition of roots})x+(\text{Product of roots})=0$

or, $x^2-\left(-\frac{b}{a}\right)x+\left(\frac{c}{a}\right)=0$

$\alpha+\beta=-b/a$

$\alpha\beta=c/a$

or, $ax^2+bx+c=0$

$x^2-(\Sigma\alpha)x+(\Sigma\alpha\beta)=0$

$-$ $+$

α, β, γ → Three roots in the equation

Equation: $x^3-(\alpha+\beta+\gamma)x^2+(\alpha\beta+\beta\gamma+\gamma\alpha)x-\alpha\beta\gamma=0$

or, $x^3-(-b/a)x^2+(c/a)x-(-d/a)=0$

or, $ax^3+bx^2+cx+d=0$

$\alpha+\beta+\gamma=-b/a$

$\alpha\beta+\beta\gamma+\gamma\alpha=c/a$

$\alpha\beta\gamma=-d/a$

$x^3-\Sigma\alpha x^2+\Sigma\alpha\beta x-\Sigma\alpha\beta\alpha=0$

$-$ $+$ $-$

$x^4-\Sigma\alpha x^3+\Sigma\alpha\beta x^2-\Sigma\alpha\beta\alpha x+\Sigma\alpha\beta\alpha\delta=0$

$-$ $+$ $-$ $+$

$x^5-\Sigma\alpha x^4+\Sigma\alpha\beta x^3-\Sigma\alpha\beta\alpha x^2+\Sigma\alpha\beta\alpha\delta x-\Sigma\alpha\beta\alpha\delta\sigma=0$

$-$ $+$ $-$ $+$ $-$

Subject :

Date :

General Idea of polynomial Equation

1

$ax^2+bx+c=0$

- $\alpha+\beta = \Sigma\alpha = -b/a$ (−)
- $\alpha\beta = \Sigma\alpha\beta = c/a$ (+)

2

$ax^3+bx^2+cx+d=0$

- $\alpha+\beta+\gamma = \Sigma\alpha = -b/a$ (−)
- $\alpha\beta+\beta\gamma+\gamma\alpha = \Sigma\alpha\beta = c/a$ (+)
- $\alpha\beta\gamma = \Sigma\alpha\beta\gamma = -d/a$ (−)

3

$ax^4+bx^3+cx^2+dx+e=0$

$(\alpha+\beta+\gamma+\delta) = \Sigma\alpha = -b/a$ (−)

$(\alpha\beta+\beta\gamma+\gamma\delta+\alpha\gamma+\alpha\delta+\beta\delta) = \Sigma\alpha\beta = c/a$ (+)

$(\alpha\beta\gamma+\alpha\beta\delta+\alpha\gamma\delta+\beta\gamma\delta) = \Sigma\alpha\beta\gamma = -d/a$ (−)

$(\alpha\beta\gamma\delta) = \Sigma\alpha\beta\gamma\delta = e/a$ (+)

4

$ax^5+bx^4+cx^3+dx^2+ex+f=0$

$\alpha+\beta+\gamma+\delta+\sigma = \Sigma\alpha = -b/a$ (−)

$(\alpha\beta+\beta\gamma+\gamma\delta+\alpha\gamma+\alpha\delta+\beta\delta+\alpha\sigma+\beta\sigma+\delta\sigma+\gamma\sigma) = \Sigma\alpha\beta = c/a$ (+)

$(\alpha\beta\gamma+\alpha\beta\delta+\alpha\beta\sigma+\beta\gamma\delta+\alpha\beta\sigma+\beta\gamma\sigma+\gamma\delta\sigma+\beta\delta\sigma) = \Sigma\alpha\beta\gamma = -d/a$ (−)

$(\alpha\beta\gamma\delta+\alpha\beta\gamma\sigma+\alpha\beta\delta\sigma+\beta\gamma\delta\sigma+\alpha\gamma\delta\sigma) = \Sigma\alpha\beta\gamma\delta = e/a$ (+)

$(\alpha\beta\gamma\delta\sigma) = \Sigma\alpha\beta\gamma\delta\sigma = -f/a$ (−)

HEART'S

Subject : Binomial Expansion Quarantine   Date :

n is the power/ index in all the instances

$^nC_r = {}^nC_{n-r}$

$$^nC_r = \frac{n!}{r!\,(n-r)!}$$

$$= \frac{n(n-1)(n-2)\ldots\ldots(n-(r+1))\cancel{(n-r)!}}{r!\,\cancel{(n-r)!}}$$

$$= \frac{n(n-1)(n-2)\ldots\ldots(n-(r+1))}{r!}$$

When index is $n>1$

- When index is n, number of total terms is $(n+1)$
- r starts from 0, term count starts from 1

$r = 0, 1, 2, 3, 4 \ldots\ldots \infty$

term $= 1, 2, 3, 4, 5, 6 \ldots\ldots \infty$

term $= (r+1)$

When $r = 7$, the term is $(7+1)$ 8th or, 8th

$^nC_0 = 1$ $\quad ^nC_1 = \frac{n}{1!}$

$^nC_2 = \frac{n(n-1)}{2!}$

$^nC_3 = \frac{n(n-1)(n-2)}{3!}$

$^nC_4 = \frac{n(n-1)(n-2)(n-3)}{4!}$

Since |r| and $n > 1$, the sequence will end.

$$(a+x)^n = {}^nC_0\, a^n + {}^nC_1\, a^{n-1}x^1 + {}^nC_2\, a^{n-2}x^2 + \ldots\ldots + {}^nC_{n-1}\, a x^{n-1} + {}^nC_n\, x^n$$

$$(r+1)\text{th term} = T_{r+1} = {}^nC_{(r)}\, a^{(n-r)} x^{(r)}$$

Even power/ index has middle term $\left(\frac{n}{2}+1\right)$th term.

Odd power/ index has middle terms $\left(\frac{n+1}{2}\right)$th & $\left(\frac{n+3}{2}\right)$th term.

HEART'S

$1 + \frac{n}{1!}x^1 + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \frac{n(n-1)(n-2)(n-3)}{4!}x^4$

Date :

Subject :

Important

This is continuation series. It has to be written out before every math problem.

(Chapter 5.2)

When $|x| < 1$ and n is negative or fractional

$$(1+x)^n = 1 + \underset{\substack{\downarrow \\ n \times x}}{nx} + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \ldots$$

$$\ldots + \underbrace{(1)^r (x)^r \frac{n(n-1)(n-2)(n-3)\ldots(n-r+1)}{r!}}_{T_{r+1} \text{ (General term)}}$$

$\ldots + \infty$

$$(1-x)^n = 1 - \underset{\substack{\downarrow \\ n \times -x}}{nx} + \frac{n(n-1)}{2!}x^2 - \frac{n(n-1)(n-2)}{3!}x^3 + \ldots$$

$$\ldots + \underbrace{(1)^r (-x)^r \frac{n(n-1)(n-2)(n-3)\ldots(n-r+1)}{r!}}_{T_{r+1} \text{ (General Term)}}$$

$\ldots + \infty$

$$(1+x)^{-n} = 1 - \underset{\substack{\downarrow \\ -n \times x}}{nx} + \frac{n(n+1)}{2!}x^2 - \frac{n(n+1)(n+2)}{3!}x^3 + \ldots$$

$$\ldots + \underbrace{(-1)^r (x)^r \frac{n(n+1)(n+2)(n+3)\ldots(n+r-1)}{r!}}_{T_{r+1} \text{ (General Term)}}$$

$\ldots + \infty$

$$(1-x)^{-n} = 1 + \underset{\substack{\downarrow \\ (-n)(-x)}}{nx} + \frac{n(n+1)}{2!}x^2 + \frac{n(n+1)(n+2)}{3!}x^3 + \ldots$$

$$\ldots + \underbrace{(-1)^r (-x)^r \frac{n(n+1)(n+2)(n+3)\ldots(n+r-1)}{r!}}_{T_{r+1} \text{ (General Term)}}$$

$\ldots + \infty$

HEARTS

Subject : In 5.2, distinction between continuation series and general term has to be figured out for proper understanding of concepts.

Date :

$(1\pm x)^{-n}$ $(n+r-1)$

When x is $|x|<1$ & n is 1, -1, 2, -2, 3, -3

Continuation Series

General Term

$(1-x)^{-1} = 1+x+x^2+x^3+\ldots\infty$

1 1 1 1

$(1-x)^{-2} = 1+2x+3x^2+4x^3+\ldots\infty$

1 2 3 4

$(1-x)^{-3} = 1+3x+6x^2+10x^3+\ldots\infty$

1 3 6 10

$T_{r+1} = (-1)^r(-x)^r \frac{n(n+1)(n+2)\ldots(n+r-1)}{r!}$

Here n is not -1, but 1.

For 4th term, $r=3$, highest value $=(n+r-1)=(n+3-1)=(n+2)$

$(1+x)^{-1} = 1-x+x^2-x^3+\ldots\infty$

1 − + − +

$(1+x)^{-2} = 1-2x+3x^2-4x^3+\ldots\infty$

1 − + − +

$(1+x)^{-3} = 1-3x+6x^2-10x^3+\ldots\infty$

1 − + − +

$T_{r+1} = (-1)^r(x)^r \frac{n(n+1)(n+2)\ldots(n+r-1)}{r!}$

Here n is not -1, but 1.

$|x|<1$ $(1+x)^n$, $T_{r+1} = (1)^r(x)^r \frac{n(n-1)(n-2)(n-3)\ldots(n-r+1)}{r!}$

$|x|<1$ $(1-x)^n$, $T_{r+1} = (1)^r(-x)^r \times \frac{n(n-1)(n-2)(n-3)\ldots(n-r+1)}{r!}$

$|x|<1$ $(1-x)^{-n}$, $T_{r+1} = (-1)^r(-x)^r \times \frac{n(n+1)(n+2)(n+3)\ldots(n+r-1)}{r!}$

$|x|<1$ $(1+x)^{-n}$, $T_{r+1} = (-1)^r(x)^r \times \frac{n(n+1)(n+2)(n+3)\ldots(n+r-1)}{r!}$

Most important General Terms

Subject : Partial Fractions Quarantine   Date :

Proper Fractions : Numerator is of lower degree than denominator

Example : $\frac{3x}{(x+1)(2-x)}$ → ① → ②

① ③ $\frac{3x}{(x+1)(x+2)(2-x)} = \frac{A}{(x+1)} + \frac{B}{(2-x)} + \frac{C}{(x+2)}$

① ③ $\frac{3x}{(x+1)(4x^2-4)}$ or, $\frac{3x}{(x+1)(2x+3)(2x-3)} = \frac{A}{x+1} + \frac{B}{2x+3} + \frac{C}{2x-3}$

.... $3x/x^2+6x+5$ .... $3x/(x+1)(x-2)^2$ ..... proper fractions.

Improper Fractions : Numerator is of same/higher degree than denominator

② ② $\frac{x^2}{(x+1)(x-2)} = A + \frac{B}{(x+1)} + \frac{C}{(x-2)}$ [same high degree power]

③ ② $\frac{x^3}{(x+1)(x-2)} = (Ax+B) + \frac{C}{(x+1)} + \frac{D}{(x-2)}$ [higher numerator degree]

Subject : Date :

Self Study:

$(1-3x)^{-1}$

$= (3x)^0 + (3x)^1 + (3x)^2 + (3x)^3 + (3x)^4 + \dots + (3x)^n + \dots \infty$

$\boxed{\text{key takes}}$

resembles $(1-x)^{-1}$

$\rightarrow T_{r+1} = (-1)^r (-x)^r \left(\frac{1(1+1)(1+2)(1+3)\dots(1+r-1)}{r!} \right)$

$= (-1)^r (-1)^r (x)^r \left(\frac{r!}{r!} \right)$

$= (-1)^{2r} \cdot x^r \cdot 1$

$= x^r$

HEART'S

Subject : [redacted] Measures of dispersion   Date :

Range : Highest Value − Lowest Value : $\boxed{x_n - x_1}$ Ungrouped

[redacted] : (Upper Limit of upper class) − (Lower Limit of lower class) : $\boxed{H - L}$ Grouped

Coefficient of Range : $\boxed{\dfrac{x_n - x_1}{x_n + x_1} \times 100\%}$ Ungrouped Data

: $\boxed{\dfrac{H - L}{H + L} \times 100\%}$ Grouped Data

$\dfrac{\text{Negative}}{\text{Positive}} \times 100\%$

Quartile Deviation : $\boxed{\dfrac{Q_3 - Q_1}{2}}$

Coefficient of Quartile Deviation : $\boxed{\dfrac{Q_3 - Q_1}{Q_3 + Q_1} \times 100\%}$

AM VS PM

AMVS

Arithmetic Mean : $\boxed{\bar{x} = \dfrac{\sum f_i x_i}{N}}$ Grouped

Grouped Data has frequency & N

Mean Deviation : $\boxed{\dfrac{\sum f_i \left| x_i - \bar{x} \right|}{N}}$ Grouped

σ^2 = Variance = $\boxed{\dfrac{\sum f_i (x_i - \bar{x})^2}{N}}$ Grouped

σ = Standard Deviation = $\boxed{\sqrt{\dfrac{\sum f_i (x_i - \bar{x})^2}{N}}}$ Grouped

Ungrouped Data has no frequency and n

- f_i = Frequency = Range + 1
- N = Total Frequency in all the groups.
- x_i = Median/Midpoint of a class

Subject : Date :

For x_1, x_2 , $\boxed{\text{Mean Deviation} = \text{Standard Deviation} = \frac{\text{Range}}{2}}$

Variance of n natural numbers $= \boxed{\frac{n^2-1}{12}}$ • 1,2,3,4,5.....n

Variance of first even/first odd natural numbers $= \boxed{\frac{n^2-1}{3}}$ • 2,4,6,8,10....n • 1,3,5,7,9.....n

Standard Deviation of two numbers $= \boxed{\frac{|x_1 - x_2|}{2}}$

Coefficient of mean Deviation $= \boxed{\frac{\text{Mean Deviation}}{\text{Arithmetic Mean}} \times 100\%}$

Coefficient of variation $= \boxed{\frac{\text{Standard Deviation}}{\text{Arithmetic Mean}} \times 100\%}$

Class	f_i	x_i	$f_i x_i$	$\bar{x}$	$f_i \lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert^2$

Arithmetic mean : $\bar{x} = \frac{\sum x_i}{n}$

Ungrouped

Mean Deviation : $\frac{\sum |x_i - \bar{x}|}{n}$

Ungrouped

σ^2 = Variance : $\frac{\sum (x_i - \bar{x})^2}{n}$

Ungrouped

σ = Standard Deviation : $\sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$

Ungrouped

AM VS PM

AMVS

Ungrouped data

x_i = individual datas

n = Total number of datas

HEARTS

Subject :   Date :

Probability

Gambling : 52 cards = (13×4) cards

26 Black
- 1 Black spades — S
  - 3 Face cards: King Queen & Jack. (KQJ)
  - 1 Ace
  - 9 numbered card from 2 to 10
- 2 Black clubs — C

26 Red
- 3 Red Diamonds — D
- 4 Red Heart — H

HDCS