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Question No 1:

a) Graph's equation (Absolute Graph)

point $(2,-1) \longrightarrow$ vertex

$(2,-1) \longrightarrow (h,k)$

$y = a|x-h| + k$

$y = |x-2| + (-1)$

$\boxed{y = |x-2|-1} \longrightarrow$ equation of Absolute function

b) polynomial 3rd degree (Continuous graph)

points on Graph $A(1,0)$ $B(-2,0)$, $C(-2,0)$

y-intercept $(0,-4)$

This equation has equal and one distinct real root

$(x-1)(x-(-2))(x-(-2)) = y$

$(x-1)(x+2)(x+2) = y$

$(x-1)(x+2)^2 = y$

$(x-1)(x^2+2(x)(2)+4) = y$

$(x-1)(x^2+4x+4) = y$

$x(x^2+4x+4) - 1(x^2+4x+4) = y$

$x^3+4x^2+4x-x^2-4x-4 = y$

$x^3+4x^2-x^2-4 = y$

$\boxed{x^3+3x^2-4 = y} \longrightarrow$ equation of cubic polynomial

c) A line is cutting the curve at two points

cutting point of line $\longrightarrow (4,5)$ and $(0,-3)$

intercepts of curve $x \rightarrow (3,0), (-1,0)$, $y \rightarrow (0,-3)$

equation of curve

$y = (x-\alpha)(x-\beta)$

$y = (x-(3))(x-(-1))$

$y = (x-3)(x+1)$

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

$\boxed{y = x^2-2x-3}$

$\rightarrow$ parabola's equation

equation of line

$\boxed{m = 2}$

point slope form

$y - y_1 = m(x-x_1)$, $(4,5)$

$y-5 = 2(x-4)$

$y-5 = 2x-8$

$\boxed{y = 2x-3}$

$\rightarrow$ line's equation

Question No 2:- Solve and sketch the inequalities.

(i) $\dfrac{(x+1)(x-3)}{(x+4)} \geq 0$

Solution

$(x+1)(x-3) \geq 0(x+4)$

$(x+1)(x-3) \geq 0$

$x^2 - 3x + x - 3 \geq 0$

$x(x-3) + 1(x-3) \geq 0$

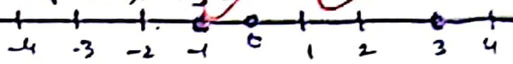
$(x+1)(x-3) \geq 0$

$\boxed{x \geq -1}$ $\boxed{x \geq 3}$

Intervals

$(-1, 3)$

$[-\infty, -1]\ [-1, 3]\ [3, \infty^+]$



$[-\infty, -1] \cup [3, \infty)$

$x = -2$	$x = 0$	$x = 4$
$\dfrac{(x+1)(x-3)}{(x+4)} \geq 0$	$\dfrac{(x+1)(x-3)}{(x+4)} \geq 0$	$\dfrac{(x+1)(x-3)}{(x+4)} \geq 0$
$\dfrac{(-1)(-5)}{2} \geq 0$	$\dfrac{(1)(-3)}{4} \geq 0$	$\dfrac{(5)(1)}{8} \geq 0$
$\boxed{5/2 \geq 0}$ ✓	$\boxed{-3/4 \geq 0}$	$\boxed{5/8 \geq 0}$
True	False	True

ii) $x^2 - x < 12$

Solution

$x^2 - x - 12 < 0$

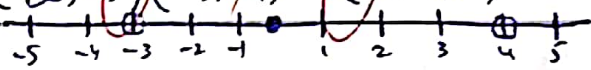
$x^2 - 4x + 3x - 12 < 0$

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

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

$\boxed{x < -3}$ $\boxed{x < 4}$

$(-\infty, -3)\ (-3, 4)\ (4, \infty^+)$



$(-3, 4)$

$x = -4$	$x = 0$	$x = 5$
$x^2 - x < 12$	$x^2 - x < 12$	$x^2 - x < 12$
$(-4)^2 - (-4) < 12$	$(0)^2 - (0) < 12$	$(5)^2 - (5) < 12$
$16 + 4 < 12$	$\boxed{0 < 12}$	$25 - 5 < 12$
$\boxed{20 < 12}$		$\boxed{20 < 12}$
False	True	False

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Question No. 3.

a) if $z = x+iy$ and $\bar{z}$ is the conjugate of z, find the values of x and y such that $\frac{1}{z} + \frac{3}{\bar{z}} = i+1$

Solution

$$z = x+iy \quad , \quad \bar{z} = x-iy$$

$$\frac{1}{z} + \frac{3}{\bar{z}} = i+1$$

$$= \frac{1}{x+iy} + \frac{3}{x-iy} = i+1$$

$$= \frac{x-iy+3(x+iy)}{(x+iy(x-iy)} = i+1$$

$$= x-iy+3x+3iy = i+1\,(x+iy)\,(x-iy)$$

$$= x-iy+3x+3iy = i+1\,(x^2-(iy)^2)$$

$$= 4x+2iy = i+1\,(x^2-(i)^2y^2)$$

$$= 4x+2iy = i+1\,(x^2-(-1)y^2)$$

$$= 4x+2iy = i+1\,(x^2+y^2)$$

$$= 4x+2iy = i(x^2+y^2)+1(x^2+y^2)$$

$$= 4x+2iy = ix^2+iy^2+x^2+y^2$$

using Comparing method

Real = Real , imaginary = imaginary

$$\boxed{4x = x^2+y^2} \quad , \quad 2iy = ix^2+iy^2$$

$$i(2y) = i(x^2+y^2)$$

$$\frac{\cancel{i}(2y)}{\cancel{i}} = x^2+y^2$$

$$\boxed{2y = x^2+y^2}$$

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d) Cubic polynomial's graph

Three distinct real roots

(2,0), (0,0), (−2,0) $\longrightarrow$ x-intercepts

(0,0) $\longrightarrow$ y-intercept

$y = (x-\alpha)(x-\beta)(x-\gamma)$

$y = (x-2)(x-0)(x-(-2))$

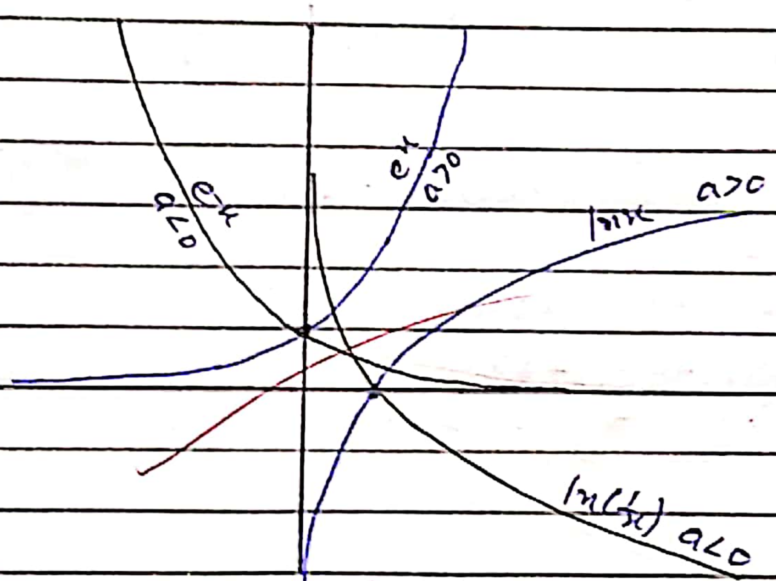
$y = (x-2)(x)(x+2)$

$y = (x-2)(x+2)(x)$ difference of two square formulae

$y = x^2 - 4(x)$

$\boxed{y = x^3 - 4x} \longrightarrow$ equation of cubic polynomial

e)



Domain of exponential function

$\mathbb{R}\ (-\infty, \infty^+)$

Range of exponential function

$(0, \infty^+)$

Exponential graph always passes through $(0, 1)$

Domain of logarithmic function

$(0, \infty^+)$

Range of logarithmic function

$\mathbb{R}\ (-\infty, \infty^+)$

logarithmic graph always passes through $(1, 0)$

a) find the slope and y-intercept of the line that is parallel to $2x+3y=5$ and passes through the point $(1,-1)$.

Solution

$2x+3y=5$

$3y=5-2x$

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

$y=mx+c$

$\boxed{m=-2/3}$

Slope $= m = -2/3$, point $(1,-1)$

using point slope form

$y-y_1=m(x-x_1)$

$y-(-1)=\frac{-2}{3}(x-1)$

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

$3y+3=-2x+2$

$3y+2x=2-3$

$\boxed{3y+2x+1=0}$

$ax+by+c=0$

b) find $\frac{f(2+h)-f(2)}{h}$ if $f(x)=x^2+2x-1$

Solution

$f(2+h)=(2+h)^2+2(2+h)-1$

$f(2+h)=(4+4h+h^2)+4+2h-1$

$f(2+h)=h^2+4h+4+4+2h-1$

$\boxed{f(2+h)=h^2+6h+7} \rightarrow f(2+h)$

$\boxed{f(2)}$

$f(2)=x^2+2x-1$

$f(2)=(2)^2+2(2)-1$

$f(2)=4+4-1$

$\boxed{f(2)=7} \rightarrow f(2)$

$\frac{f(2+h)-f(2)}{h}$

$=\frac{(h^2+6h+7)-(7)}{h}$

$=\frac{h^2+6h}{h}=\frac{h(h+6)}{h}=\boxed{h+6}$

$\frac{f(2+h)-f(2)}{h}=\boxed{h+6}$

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b) Solve for real x & y, $x+iy = (1-i)(2+8i)$

Solution

$$x+iy = (1-i)(2+8i)$$
$$x+iy = 1(2+8i) - i(2+8i)$$
$$x+iy = 2+8i-2i-8i^2$$
$$x+iy = 2+6i-8(-1)$$
$$x+iy = 2+6i+8$$
$$x+iy = 10+6i$$

Using comparing method

$\boxed{x=10}$ and $\boxed{y=6}$

verifying

→ $x=10$ and $y=6$

$$x+iy = (1-i)(2+8i)$$
$$10+6i = 1(2+8i) - i(2+8i)$$
$$= 2+8i-2i-8i^2$$
$$= 2+6i-8(-1)$$
$$= 2+6i+8$$
$$= 6i+10$$

$\boxed{10+6i = 6i+10}$ → verified ✓