Workshop Solutions to Sections 2.1 and 2.2(1.1 & 1.2)

1) Find the domain of the function $f(x) = 9 - x^2$.	2) Find the range of the function $f(x) = 9 - x^2$.
Solution:	Solution:
Since $f(x)$ is a polynomial, then	$R_f = (-\infty, 9]$
$D_f = \mathbb{R} = (-\infty, \infty)$	
Note: The domain of any polynomial is \mathbb{R} .	
3) Find the domain of the function $f(x) = 6 - 2x$.	4) Find the range of the function $f(x) = 6 - 2x$.
Solution:	Solution:
Since $f(x)$ is a polynomial, then	Since $f(x)$ is a polynomial of degree one (<i>i.e.</i> is of an odd degree), then
$D_f = \mathbb{R} = (-\omega, \omega)$	$R_c = \mathbb{R} = (-\infty, \infty)$
5) Find the domain of the function $f(x) = x^2 - 2x - 3$	6) Find the domain of the function $f(x) = 1 + 2x^3 - x^5$
Solution:	Solution:
Since $f(x)$ is a polynomial, then	Since $f(x)$ is a polynomial, then
$D_f = \mathbb{R} = (-\infty, \infty)$	$D_f = \mathbb{R} = (-\infty, \infty)$
7) Find the domain of the function $f(x) = 5$.	8) Find the range of the function $f(x) = 5$.
Solution:	Solution:
Since $f(x)$ is a polynomial, then	$R_f = \{5\}$
$D_f = \mathbb{R} = (-\infty, \infty)$	
9) Find the domain of the function $f(x) = x - 1 $.	10) Find the domain of the function $f(x) = x + 5 $.
Solution:	Solution:
Since $f(x)$ is an absolute value of a polynomial, then	Since $f(x)$ is an absolute value of a polynomial, then
$D_f = \mathbb{R} = (-\infty, \infty)$	$D_f = \mathbb{R} = (-\infty, \infty)$
Note: The domain of an absolute value of any polynomial is \mathbb{R}	
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Note: The domain of an absolute value of any polynomial is \mathbb{R} . 11) Find the domain of the function $f(x) = x $. Solution: Since $f(x)$ is an absolute value of a polynomial, then $D_f = \mathbb{R} = (-\infty, \infty)$ 13) Find the domain of the function $f(x) = 3x - 6 $.	12) Find the range of the function $f(x) = x $. Solution: $R_f = [0, \infty)$ Note: The range of an absolute value of any polynomial is always $[0, \infty)$. 14) Find the domain of the function $f(x) = 9 - 3x $.
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17) Find the domain of the function	18) Find the domain of the function
$f(x) = \frac{x+2}{x+2}$	$f(x) = \frac{x+2}{x+2}$
Solution: $x^2 - 9$	$x^2 - 5x + 6$
<u>Solution</u> . $f(x)$ is defined when $x^2 - 0 \neq 0 \implies x^2 \neq 0 \implies x \neq +3$	Solution: $f(x)$ is defined when $x^2 - 5x + 6 \neq 0$
$f(x)$ is defined when $x = j \neq 0 \implies x \neq j \implies x \neq \pm 3$.	$\Rightarrow (r-2)(r-3) \neq 0 \Rightarrow r \neq 2 \text{ or } r \neq 3 \text{ So}$
$D_{\epsilon} = \mathbb{R} \setminus \{-3,3\} = (-\infty, -3) \cup (-3,3) \cup (3,\infty)$	$\rightarrow (x - 2)(x - 3) \neq 0 \rightarrow x \neq 2 \text{ or } x \neq 3.30,$
	$D_f = \mathbb{R} \setminus \{2,3\} = (-\infty, 2) \cup (2,3) \cup (3,\infty)$
19) Find the domain of the function	20) Find the domain of the function
f(x) = x + 2	f(x) = x + 2
$f(x) = \frac{1}{x^2 - x - 6}$	$f(x) = \frac{1}{x^2 + 9}$
Solution:	Solution:
$f(x)$ is defined when $x^2 - x - 6 \neq 0$	$f(x)$ is defined when $x^2 + 9 \neq 0$ but for any value x the
$\Rightarrow (x+2)(x-3) \neq 0 \Rightarrow x \neq -2 \text{ or } x \neq 3. \text{ So},$	denominator $x^2 + 9$ cannot be 0. So,
$D_f = \mathbb{R} \setminus \{-2,3\} = (-\infty, -2) \cup (-2,3) \cup (3,\infty)$	$D_f = \mathbb{R} = (-\infty, \infty)$
21) Find the domain of the function	22) Find the domain of the function
$f(x) = \sqrt[3]{x-3}$	$f(x) = \sqrt{x-3}$
Solution:	Solution:
$D_f = \mathbb{R} = (-\infty, \infty)$	$f(x)$ is defined when $x - 3 \ge 0 \implies x \ge 3$ because $f(x)$
	is an even root. So,
Note: The domain of an odd root of any polynomial	$D_f = [3, \infty)$
is ${\mathbb R}$.	
23) Find the domain of the function	24) Find the domain of the function
$f(x) = \sqrt{3 - x}$	$f(x) = \sqrt{x+3}$
Solution:	Solution:
$f(x)$ is defined when $3 - x \ge 0 \implies -x \ge -3 \implies x \le 3$	$f(x)$ is defined when $x + 3 \ge 0 \implies x \ge -3$ because
because $f(x)$ is an even root. So,	f(x) is an even root. So,
$D_f = (-\infty, 3]$	$D_f = [-3, \infty)$
25) Find the domain of the function	26) Find the range of the function
$f(x) = \sqrt{-x}$	$f(x) = \sqrt{-x}$
Solution: $f(x)$ is defined when $x > 0 \rightarrow x < 0$ because $f(x)$ is	Solution: $P = [0, \infty)$
$f(x)$ is defined when $-x \ge 0 \implies x \le 0$ because $f(x)$ is	$R_f = [0, \infty)$
$D_c = (-\infty \ 0]$	
D_f (D_f , D_f)	NOLE: The range of an even root is always ≥ 0 .
27) Find the domain of the function $\frac{1}{2}$	28) Find the domain of the function $r + 2$
$f(x) = \sqrt{9 - x^2}$	$f(x) = \frac{x+2}{\sqrt{x-2}}$
<u>Solution</u> : $f(x)$ is defined when $9 - x^2 > 0 \rightarrow -x^2 > -9 \rightarrow -x^2$	Solution: $\sqrt{x-5}$
$y(x)$ is defined when $y - x \ge 0 \implies -x \ge -y \implies$	$f(x)$ is defined when $x - 3 > 0 \implies x > 3$. So,
$x \leq 9 \rightarrow \forall x^2 \leq \sqrt{9} \rightarrow x \leq 3 \rightarrow -3 \leq x \leq 3$.	$D_f = (3, \infty)$
$D_{\ell} = [-3.3]$	
29) Find the domain of the function	30) Find the domain of the function
x+2	$f(x) = \sqrt{x^2 - 9}$
$f(x) = \frac{1}{\sqrt{9 - x^2}}$	Solution:
Solution:	$f(x)$ is defined when $x^2 - 9 \ge 0 \implies x^2 > 9$
$f(x)$ is defined when $9 - x^2 > 0 \implies -x^2 > -9$	$\Rightarrow \sqrt{x^2} > \sqrt{9} \Rightarrow x > 3 \Rightarrow x > 3 \text{ or } x < -3$
$\Rightarrow x^2 < 9 \Rightarrow \sqrt{x^2} < \sqrt{9} \Rightarrow x < 3 \Rightarrow -3 < x < 3.$	
So,	$D_f = (-\infty, -3] \cup [3, \infty)$
$D_f = (-3,3)$	· · · · · · · ·

31) Find the range of the function	32) Find the domain of the function
$f(x) = \sqrt{x^2 - 9}$	$f(x) = \frac{x+2}{x+2}$
Solution:	$\int (x) = \sqrt{x^2 - 9}$
$R_f = [0, \infty)$	Solution:
	$f(x)$ is defined when $x^2 - 9 > 0 \implies x^2 > 9$
	$\Rightarrow \sqrt{x^2} > \sqrt{9} \Rightarrow x > 3 \Rightarrow x > 3 \text{ or } x < -3.$
	So,
	$D_f = (-\infty, -3) \cup (3, \infty)$
33) Find the domain of the function	34) Find the domain of the function
$f(x) = \sqrt{9 + x^2}$	$f(x) = \sqrt[4]{x^2 - 25}$
Solution:	Solution:
$f(x)$ is defined when $9 + x^2 \ge 0$ but it is always true for	$f(x)$ is defined when $x^2 - 25 \ge 0 \implies x^2 \ge 25$
any value x . So,	$\Rightarrow \sqrt{x^2} \ge \sqrt{25} \Rightarrow x \ge 5 \Rightarrow x \ge 5 \text{ or } x \le -5.$
$D_f = \mathbb{R}$	So,
	$D_f = (-\infty, -5] \cup [5, \infty)$
35) Find the domain of the function	36) Find the range of the function
$f(x) = \sqrt[6]{16 - x^2}$	$f(x) = \sqrt{16 - x^2}$
Solution:	Solution:
$f(x)$ is defined when $16 - x^2 \ge 0 \implies -x^2 \ge -16 \implies$	We know that $f(x)$ is defined when $16 - x^2 \ge 0$
$x^2 \le 16 \implies \sqrt{x^2} \le \sqrt{16} \implies x \le 4 \implies -4 \le x \le 4$.	$\Rightarrow -x^2 \ge -16 \Rightarrow x^2 \le 16 \Rightarrow \sqrt{x^2} \le \sqrt{16}$
So,	\Rightarrow $ x \le 4 \Rightarrow -4 \le x \le 4$. So,
$D_f = [-4,4]$	$D_f = [-4, 4]$
	Using D_f we find the outputs vary from 0 to 4 . Hence,
	$R_f = [0,4]$
Find the domain of the function	38) Find the domain of the function
$f(x) = \frac{x + x }{ x }$	$\left(-\frac{1}{2}\right)$ $x < 0$
$f(x) = \frac{x + x }{x}$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0 \\ 0, & x < 0 \end{cases}$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) = \frac{x + x }{x}$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_x = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $2 = \sqrt{x}$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x-1} + \sqrt{x+2}$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x} - \sqrt{x}}$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution:
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution:	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 > 0 \implies x > 1 \implies D \xrightarrow{r - 1} = [1, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$ $1 = x \ge 0 \implies D = [0, \infty)$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x - 1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x - 1}} = [-3, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 \ge 0 \text{ but this is always true for all } x$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x - 1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x + 3}} = [-3, \infty)$ Hence
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 > 0 \text{ but this is always true for all } x$ $\implies D \xrightarrow{=} \mathbb{R}.$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: $f(x) \text{ is defined when}$ $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x - 1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x + 3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x - 1}} \cap D_{\sqrt{x - 1}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 > 0 \text{ but this is always true for all } x$ $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x - 1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x + 3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x - 1}} \cap D_{\sqrt{x + 3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 > 0 \text{ but this is always true for all } x$ $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence, $D_f = D = 0 \text{ for } 0 D = [0, \infty) \cap \mathbb{R} = [0, \infty)$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x - 1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x + 3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x - 1}} \cap D_{\sqrt{x + 3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$
$f(x) = \frac{x + x }{x}$ <u>Solution:</u> $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ <u>Solution:</u> $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 > 0 \text{ but this is always true for all } x$ $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2 + 1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1 \text{ is a polynomial}$	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function
$f(x) = \frac{x + x }{x}$ Solution: $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) \text{ is defined when}$ 1- $x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ 2- $x^2 + 1 > 0$ but this is always true for all x $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2 + 1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1$ is a polynomial function.	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function.
$f(x) = \frac{x + x }{x}$ Solution: $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 > 0 \text{ but this is always true for all } x$ $\implies D_{\sqrt{x^2+1}} = \mathbb{R}.$ Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2+1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1$ is a polynomial function. 43) The function $f(x) = -3x^2 + 7$ is a quadratic	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: $f(x) \text{ is defined when}$ $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function. 44) The function $f(x) = 2x + 3$ is a linear function.
$f(x) = \frac{x + x }{x}$ Solution: $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) \text{ is defined when}$ 1- $x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ 2- $x^2 + 1 > 0$ but this is always true for all x $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2 + 1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1$ is a polynomial function. 43) The function $f(x) = -3x^2 + 7$ is a quadratic function.	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function. 44) The function $f(x) = 2x + 3$ is a linear function.
$f(x) = \frac{x + x }{x}$ Solution: $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) \text{ is defined when}$ $1 - x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ $2 - x^2 + 1 > 0 \text{ but this is always true for all } x$ $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2 + 1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1$ is a polynomial function. 43) The function $f(x) = -3x^2 + 7$ is a quadratic function.	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function. 44) The function $f(x) = 2x + 3$ is a linear function.
$f(x) = \frac{x + x }{x}$ Solution: $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) \text{ is defined when}$ 1- $x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ 2- $x^2 + 1 > 0$ but this is always true for all x $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}$. Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2 + 1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1$ is a polynomial function. 43) The function $f(x) = -3x^2 + 7$ is a quadratic function. 45) The function $f(x) = x^7$ is a power function.	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x - 1} + \sqrt{x + 3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function. 44) The function $f(x) = 2x + 3$ is a linear function. 46) The function $f(x) = \frac{2x+3}{x^2-1}$ is a rational function.
$f(x) = \frac{x + x }{x}$ Solution: $f(x) \text{ is defined when } x \neq 0. \text{ So,}$ $D_f = \mathbb{R} \setminus \{0\} = (-\infty, 0) \cup (0, \infty)$ 39) Find the domain of the function $f(x) = \frac{2 - \sqrt{x}}{\sqrt{x^2 + 1}}$ Solution: $f(x) \text{ is defined when}$ 1- $x \ge 0 \implies D_{\sqrt{x}} = [0, \infty)$ 2- $x^2 + 1 > 0$ but this is always true for all x $\implies D_{\sqrt{x^2 + 1}} = \mathbb{R}.$ Hence, $D_f = D_{\sqrt{x}} \cap D_{\sqrt{x^2 + 1}} = [0, \infty) \cap \mathbb{R} = [0, \infty)$ 41) The function $f(x) = 3x^4 + x^2 + 1$ is a polynomial function. 43) The function $f(x) = -3x^2 + 7$ is a quadratic function. 45) The function $f(x) = x^7$ is a power function. 47) The function $f(x) = \frac{x-3}{x+2}$ is a rational function and we	$f(x) = \begin{cases} -\frac{1}{x}, & x < 0\\ x, & x \ge 0 \end{cases}$ Solution: It is clear from the definition of the function $f(x)$ that $D_f = \mathbb{R} = (-\infty, \infty)$ 40) Find the domain of the function $f(x) = \sqrt{x-1} + \sqrt{x+3}$ Solution: f(x) is defined when $1 - x - 1 \ge 0 \implies x \ge 1 \implies D_{\sqrt{x-1}} = [1, \infty)$ $2 - x + 3 \ge 0 \implies x \ge -3 \implies D_{\sqrt{x+3}} = [-3, \infty)$ Hence, $D_f = D_{\sqrt{x-1}} \cap D_{\sqrt{x+3}} = [1, \infty) \cap [-3, \infty) = [1, \infty)$ 42) The function $f(x) = 5x^3 + x^2 + 7$ is a cubic function. 44) The function $f(x) = 2x + 3$ is a linear function. 46) The function $f(x) = \frac{2x+3}{x^2-1}$ is a rational function. 48) The function $f(x) = \sin x$ is a trigonometric function.

49) The function $f(x) = e^x$ is a natural exponential function	50) The function $f(x) = 3^x$ is a general exponential function
$[1011 cm cm cm 2 + \sqrt{m 2} tm m m m m m m m m m m m m m m m m m m$	1011ction. E2) The function $f(x) = -2$ is a constant function
51) The function $f(x) = x^2 + \sqrt{x} - 2$ is an algebraic function.	52) The function $f(x) = -3$ is a constant function.
53) The function $f(x) = \log_3 x$ is a general logarithmic function.	54) The function $f(x) = \ln x$ is a natural logarithmic function.
55) The function $f(x) = 3x^4 + x^2 + 1$ is	56) The function $f(x) = 9 - x^2$ is
Solution:	Solution:
$f(-x) = 3(-x)^4 + (-x)^2 + 1 = 3x^4 + x^2 + 1 = f(x)$	$f(-x) = 9 - (-x)^2 = 9 - x^2 = f(x)$
Hence,	Hence,
f(x) is an even function.	f(x) is an even function.
57) The function $f(x) = x^5 - x$ is	58) The function $f(x) = 2 - \sqrt[3]{x}$ is
Solution:	Solution:
$f(-x) = (-x)^3 - (-x) = -x^3 + x$	$f(-x) = 2 - \sqrt[5]{(-x)} = 2 - \sqrt[5]{-x} = 2 + \sqrt[5]{x}$
$= -(x^3 - x) = -f(x)$	$=-(-2-\sqrt[5]{x})$
f(x) is an odd function	Hence,
	f(x) is neither even nor odd.
59) The function $f(x) = 3x + \frac{2}{\sqrt{x^2+9}}$ is	60) The function $f(x) = \frac{3}{\sqrt{x^2+9}}$ is
Solution:	Solution:
$\frac{1}{2}$ 2 2 2	3 3 $()$
$f(-x) = 3(-x) + \frac{1}{\sqrt{(-x)^2 + 9}} = -3x + \frac{1}{\sqrt{x^2 + 9}}$	$f(-x) = \frac{1}{\sqrt{(-x)^2 + 9}} = \frac{1}{\sqrt{x^2 + 9}} = f(x)$
$\left(\begin{array}{c} 2 \end{array} \right)$	Hence,
$=-\left(3x-\frac{1}{\sqrt{x^2+9}}\right)$	f(x) is an even function.
Hence,	
f(x) is neither even nor odd.	
61) The function $f(x) = \sqrt{4 + x^2}$ is	62) The function $f(x) = 3$ is
Solution:	Solution:
$f(-x) = \sqrt{4 + (-x)^2} = \sqrt{4 + x^2} = f(x)$	Since the graph of the constant function 3 is symmetric
Hence,	about the $y - axis$, then
f(x) is an even function.	f(x) is an even function.
63) The function $f(x) = \frac{9-x^2}{1-x^2}$ is	64) The function $f(x) = \frac{x^2 - 4}{x^2}$ is
Solution	Solution
<u>Solution:</u> $0 - (-x)^2 = 0 - x^2$	<u>Solution:</u> $(-x)^2 - 4 = x^2 - 4$
$f(-x) = \frac{9 - (-x)}{(-x)^2} = \frac{9 - x}{-x^2}$	$f(-x) = \frac{(-x)^2 - 4}{(-x)^2 + 4} = \frac{x^2 - 4}{x^2 + 4} = f(x)$
(-x) - 2 - x - 2 $(0 - x^2)$	$(-x)^2 + 1 x^2 + 1$
$=-\left(\frac{y-x}{y+2}\right)$	f(x) is an even function
(x+2)	
Therefore, $f(x)$ is poither over period	
(x) is hereic even nor odd. (5) The function $f(x) = 3 x $ is	(66) The function $f(x) = x^{-2}$ is
Solution: $f(x) = S[x]$ is	Solution: $f(x) = x$ is
f(-r) = 3 (-r) = 3 r = f(r)	
Hence,	$f(x) = x^{-2} = \frac{1}{x^2}$
f(x) is an even function.	$\int_{\alpha}^{\alpha} 1 1$
	$f(-x) = \frac{1}{(-x)^2} = \frac{1}{x^2} = f(x)$
	Hence, $f(x)$ is an even function.

67) The function $f(x) = x^3 - 2x + 5$ is	68) The function $f(x) = \sqrt[3]{x^5} - x^3 + x$ is
Solution:	Solution:
$f(-x) = (-x)^3 - 2(-x) + 5 = -x^3 + 2x + 5$	$f(-x) = \sqrt[3]{(-x)^5} - (-x)^3 + (-x) = -\sqrt[3]{x^5} + x^3 - x$
$= -(x^3 - 2x - 5)$	$(\sqrt[3]{x^5}-x^3+x)f(x)$
Hence,	$= (\sqrt{x} + x) = f(x)$
f(x) is neither even nor odd.	Hence,
	f(x) is an odd function.
69) The function $f(x) = 7$ is	70) The function $f(x) = \frac{x^3-4}{3+4}$ is
Solution:	Solution: x^{3+1}
Since the graph of the constant function 7 is symmetric	$(-r)^3 - 4 - r^3 - 4 r^3 + 4$
about the $y - axis$, then	$f(-x) = \frac{(-x)^{-1}}{(-x)^{3} + 1} = \frac{x^{-1}}{x^{3} + 1} = -\frac{x^{-1}}{x^{3} + 1}$
	$(-x)^{\circ} + 1 - x^{\circ} + 1 - x^{\circ} + 1$
f(x) is an even function.	f(x) is poither even per odd
71) The function $f(x) = \frac{x^2 - 1}{3 + 2}$ is	72) The function $f(x) = x^6 - 4x^2 + 1$ is
Solution:	Solution:
$(-r)^2 - 1$ $r^2 - 1$ $r^2 - 1$	$f(-x) = (-x)^6 - 4(-x)^2 + 1 = x^6 - 4x^2 + 1 = f(x)$
$f(-x) = \frac{(-x)^{2}}{(-x)^{3}+2} = \frac{x^{2}}{(-x)^{3}+2} = -\frac{x^{2}}{(-x)^{3}+2}$	Hence,
$(-x)^{3} + 3 - x^{3} + 3 x^{3} - 3$	f(x) is an even function.
f(x) = f(x)	
f(x) is here even nor odd.	(-2)
73) The function $f(x) = x^2$ is increasing on $(0, \infty)$.	(4) The function $f(x) = x^2$ is decreasing on $(-\infty, 0)$.
75) The function $f(x) = x^3$ is increasing on $(-\infty, \infty)$.	76) The function $f(x) = x^3$ is not decreasing at all.
77) The function $f(x) = \sqrt{x}$ is increasing on $(0, \infty)$.	78) The function $f(x) = \sqrt{x}$ is not decreasing at all.
79) The function $f(x) = \frac{1}{x}$ is not increasing at all.	80) The function $f(x) = \frac{1}{x}$ is decreasing on $(-\infty, \infty)$.