

Q

Q 1)

Answer the following question

Explain the following LATEX command

\includegraphics[opt]{fname}

→ Where

fname is the name of the figure file with or without file extension. It is mandatory.

The size of a figure can also be specified through two optional fields in opt, width and height, one separated from another by a comma. Without any of the width and height, a figure is printed in its original size if one of them is specified, the other one is automatically taken in proportion.

In addition to specifying the size, a figure can also be rotated through the option angle = theta, where a positive value of theta (in degree) will rotate the figure in counter-clockwise direction and a negative value in clockwise direction.

Q 2)

What types of image formats can import from external source in LATEX?

→ The standard and widely used image formats are given in the following table.

Short name	Full name
pdf	Portable Document Format
jpeg	Joint photographic expert group
tiff	tag index file format
png	portable network graphic

Q 3)

→ Write a simple program for inserting a figure in LATEX.

```
\documentclass{article}  
\usepackage{graphicx}  
\begin{document}  
 \includegraphics{Ramanujan}  
\end{document}
```

Q 4)

→ Write a simple program in LATEX which display serial number and title to figure 2.

```
\documentclass {article}  
\usepackage {graphicx}  
\begin {document}  
 \begin {figure} [!hbt]  
 \centering  
 \includegraphics {Ramanujan}  
 \caption {Ramanujan}  
 \label {f2}  
 \end {figure}  
 \end {document}
```

Q. 5)

→ How to fix vertical position of figure in LATEX.

- 1) If ! is used, many default or preset restrictions are ignored and a figure is attempted to put in the specified position
- 2) If h is given, the figure is attempted to put in the exact position if fails and no more specifier is given by default LATEX considers the specifier t for placing the figure on the top of the next page.
- 3) If t is given, the figure is attempted to put on the top of the current page.

EXPERIMENT:

4) If  $b$  is given, the figure is attempted to put at the bottom of the current page.

Q 6) Write a program in LATEX showing both height and width of image.

→ \documentclass[12pt,a3paper]{article}

\usepackage{graphicx}

\begin{document}

\begin{figure}[!hbt]

\centering

\includegraphics[width=5cm, height=5cm]{ramanujan}

\end{figure}

\end{document}

Q. 7) Write a LATEX program which produce a scaled form of the original figure.

→ \documentclass{article}

\usepackage{graphicx}

\begin{document}

\includegraphics[scale=5]{b.jpeg}

\end{document}

Q. Answer the following question  
write a LATEX program to rotate a figure counter-clock  
wise by an angle  $45^\circ$

→ \documentclass[12pt,a3paper]{article}  
\usepackage{graphicx}  
\begin{document}  
\begin{figure}[!hbt]  
|centering.  
|includegraphics[width=5cm,angle=45]{a.jpeg}  
|caption{counter-clock wise rotation of image}  
|label{fig4}  
|end{figure}  
|end{document}.

Q. 2 Write a LATEX program to rotate a figure clockwise by  
an angle  $45^\circ$

→ \documentclass{article}  
\usepackage{graphicx}  
\begin{document}  
\begin{figure}[!hbt]

|centering.  
|includegraphics[width=5.0cm,angle=-45]{a.jpeg}  
|caption{clock wise rotation of image}  
|label{fig4}  
|end{figure}  
|end{document}

Q. 3 Write a LATEX program to insert three images side by  
side in a single figure

→

```
\documentclass{article}
\usepackage{graphicx}
\begin{document}
\begin{figure}[!hbt]
\centering
\includegraphics[width=5.0cm]{a.jpeg}
\hfill
\includegraphics[width=5.0cm]{a.jpeg}
\hfill
\includegraphics[width=5.0cm]{a.jpeg}
\caption{butterfly}
\label{f5}
\end{figure}
\end{document}
```

- Q.4) using minipage environment, write a LATEX program to insert three images side by side in a single figure.

→

```
\documentclass[12pt,a3paper]{article}
\usepackage{graphicx}
\begin{document}
\begin{figure}[!hbt]
\begin{minipage}{0.4\linewidth}
\includegraphics[width=5.0cm]{a.jpeg}
\hfill
\includegraphics[width=5.0cm]{a.jpeg}
\hfill
\includegraphics[width=5.0cm]{a.jpeg}
\end{minipage}
\caption{butterfly photo}
\end{figure}
\end{document}
```

Q. 5)

Write a LATEX program for inserting three figures with a sub-numbering to a single row.

```
→ \documentclass{article}
\usepackage{graphicx}
\usepackage{subfig}
\begin{document}
\begin{figure}[!hbt]
\centering
\subfigure[butterfly 1]{\includegraphics[width=2.0cm]{a.jpeg}}
\label{f8}
\hfill
\subfigure[butterfly 2]{\includegraphics[width=2.0cm]{a.jpeg}}
\label{f9}
\hfill
\subfigure[butterfly 3]{\includegraphics[width=2.0cm]{a.jpeg}}
\label{f10}
\end{figure}
\end{document}
```

Q. 6)

Write a LATEX program for inserting four figures with a sub-numbering in two rows

```
→ \documentclass{article}
\usepackage{graphicx}
\usepackage{subfig}
\begin{document}
\begin{figure}[!hbt]
\centering
\subfigure{\includegraphics[width=2.0cm]{a.jpeg}}
\subfigure{\includegraphics[width=2.0cm]{a.jpeg}}
\hfill
\subfigure{\includegraphics[width=2.0cm]{a.jpeg}}
\subfigure{\includegraphics[width=2.0cm]{a.jpeg}}
\end{figure>

```

```
\subfigure  
{\includegraphics[width=5cm]{a.jpeg}}  
\hfill  
\subfigure  
{\includegraphics[width=5.0cm]{a.jpeg}}
```

Q 7) write a LATEX program for inserting a Figure in a table

```
\documentclass[12pt,a3paper]{article}  
\usepackage{graphicx}  
\usepackage{subfigure}  
\begin{document}  
\begin{table}[!hbt]  
\centering  
\begin{tabular}{|l|c|l|l|l|l|}  
\hline  
Sr. No. & Image ||  
\hline  
1 & \includegraphics[width=2.0cm]{d.jpeg} ||  
\hline  
2 & \includegraphics[width=2.0cm]{c.jpeg} ||  
\hline  
3 & \includegraphics[width=2.0cm]{e.jpeg} ||  
\hline  
4 & \includegraphics[width=2.0cm, height=2.0cm]{b.jpeg} ||  
\hline  
\end{tabular}  
\caption{Figure in table}  
\end{table}  
\end{document}
```

Q.

Answer the following questions.

Q. 1) What packages are required to write mathematical expression in LATEX?

→ Sol :-

The packages are required to write the mathematical expression in LATEX as follows.

`\usepackage{amssymb}` and `\usepackage{amsmath}`

`\documentclass{article}`

`\usepackage{amssymb, amsmath}`

Q. 2) Make a list of LATEX command for the frequently used mathematical notation.

→ LATEX commands for some frequently used notation are as follows

Description	LATEX Command	Symbol / output
1) Addition	<code>+</code>	$+$
2) subtraction	<code>-</code>	$-$
3) plus or minus	<code>\pm</code>	$\pm$
4) multiplication (times)	<code>\times</code>	$\times$
5) multiplication (dot)	<code>\cdot</code>	$\cdot$
6) division symbol	<code>\div</code>	$\div$
7) Dots	<code>\dots, \ddot{x}, \ddots, \ddots</code>	$\dots, \ddot{x}, \ddots, \ddots$
8) circle plus	<code>\oplus</code>	$\oplus$
9) not equal	<code>\neq</code>	$\neq$
10) less than or equal to	<code>\leq</code>	$\leq$

18)	greater than or equal to	\geq	$\geq$
19)	approximately equal to	\approx	$\approx$
1A)	single sub and super-script	$x^{-p}, x^2$	$x^i, x^{2^k}$
1B)	multiple sub/super scripts	$x-\{ij\}, x^{\{2k\}}$	$x_{ij}, x^{2k}$
1C)	Fraction	\frac{a}{b}	$a/b$
1D)	Square root	\sqrt{x}, \sqrt[3]{xyz}	$\sqrt{x}, \sqrt[3]{xyz}$
1E)	exists/not exists	\exists, \nexists	$\exists, \nexists$

Q. 3) Make a list of LATEX commands for the frequently used delimiters

Delimiter	LATEX command	Delimiter	LATEX command
( $\frac{x}{y}$ )	\left(\frac{x}{y}\right)	( $\frac{x}{y}$ )	\big(\frac{x}{y}\big)
{ $\frac{x}{y}$ }	\left\{\frac{x}{y}\right\}	{ $\frac{x}{y}$ }	\bigg\{\frac{x}{y}\bigg\}
[ $\frac{x}{y}$ ]	\left[\frac{x}{y}\right]	[ $\frac{x}{y}$ ]	\bigg[\frac{x}{y}\bigg]
$\frac{x}{y}$	\left \frac{x}{y}\right	$\frac{x}{y}$	\bigg \frac{x}{y}\bigg

(4) Make a list of commands for the frequently used ~~binary~~ operators in calculus.

Description	LATEX command	symbol / output
Derivative	$\text{frac}\{\text{df}\}\{\text{dx}\}$	$\frac{df}{dx}$
partial derivative	$\text{frac}\{\text{partial f}\}\{\text{partial x}\}$	$\frac{\partial f}{\partial x}$
integral	$\text{int}$	$\int$
double integral	$\text{mint}$	$\iint$
triple integral	$\text{miint}$	$\iiint$
limits	$\text{lim}\{-x\mid \text{tointfty}\}$	$\lim_{x \rightarrow \infty}$
summation	$\text{sum}\{n=1\}^n\{\text{lntfty}\}$ $a-n$	$\sum_{n=1}^{\infty} a_n$
product	$\text{prod}\{n=1\}^n\{\text{lntfty}\}$ $a-n$	$\prod_{n=1}^{\infty} a_n$

(5) Make a list of LATEX commands for frequently used, basic relational operators.

operator	LATEX command	operator	LATEX command
$\subset$	$\text{subset}$	$\subsetneq$	$\text{in}$
$\subseteq$	$\text{subseteq}$	$\not\subseteq$	$\text{not in}$
$\not\subset$	$\text{not subset}$	$\cong$	$\text{cong}$
$\supset$	$\text{supset}$	$\equiv$	$\text{equiv}$
$\supseteq$	$\text{supseteq}$	$\not\equiv$	$\text{not equiv}$
$\preceq$	$\text{preceq}$	$\sim$	$\text{sim}$
$\succeq$	$\text{succeq}$	$\not\sim$	$\text{not <}$
$\vdash$	$\text{vdash}$	$\dashv$	$\text{not } \succ$
$\dashv$	$\text{dashv}$	$\models$	$\text{models}$

Q. 6)

make a list of LATEX commands for the frequently used binary operators.

operator	LATEX command	operator	LATEX command
$\pm$	\pm	$\Delta$	\bigtriangledown
*	\ast	$\nabla$	\bigtriangledown
*	\star	$\nwarrow$	\lhd
\cap	\cap	$\nearrow$	\rhd
\cup	\cup	$\odot$	\bigodot
\sqcap	\sqcap	$\#$	\#
\sqcup	\sqcup	$\$$	\\$
\vee	\vee	$\wedge$	\wedge
\wedge	\wedge	$\circ/\circ$	\%

Q) Answer the following questions

a) i) Explain in-line and display Math mode for writing mathematical expressions in LATEX.

→ Inline math mode :- Sometime a short mathematical notations or expression may need to be printed in running texts also, i.e., in the same line along with texts, following are "delimiters" to typeset math in inline mode:

1]  $\text{\textbackslash} ( \dots \text{\textbackslash})$

2]  $\text{\textbackslash} $ \dots $$

3]  $\text{\textbackslash} \begin{math} \dots \text{\textbackslash} \end{math}$

For e.g.

In physics, the mass-energy equivalent is stated by the equation

$\text{\textbackslash} \begin{math}$

$E = mc^2$

$\text{\textbackslash} \end{math}$

discovered in 1905 by Albert Einstein

Output: In physics, the mass-energy equivalence is stated by the equation  $E=mc^2$ , discovered in 1905 by Albert Einstein

Display math mode :- A math-mode environment, like equation or eqnarray, prints a mathematical expression in a new line following constructions are used to typeset.

Maths in display mode

1]  $\text{\textbackslash} [ \dots \text{\textbackslash}]$

2]  $\text{\textbackslash} \begin{math} \dots \text{\textbackslash} \end{math}$

3]  $\text{\textbackslash} \begin{equation} \dots \text{\textbackslash} \end{equation}$

Q 2] create a LATEX code that formats the text shown below

Teacher's Sign:

the equation

$$ax^2 + bx + c$$

has a solution

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



```
\documentclass{article}
\begin{document}
The equation \\
\quotation $ax^2 + bx + c$ \\
has a solution \\
\quotation
$ x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} $ \\
\end{document}
```

Q 3) write a simple LATEX code for following equation

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1.$$



```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{displaymath}
\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1
\end{displaymath}
\end{document}
```

Q 4)

write a simple LATEX code for following equation.

$$p_1(n) = \lim_{n \rightarrow \infty} \sum_{r=0}^{\infty} \left( 1 - \cos^2 \left( \pi \frac{r}{n} \right) \right) \quad (1)$$



\documentclass{article}

\begin{document}

\begin{equation}

\lim\_{n \rightarrow \infty} \sum\_{r=0}^{\infty} \left( 1 - \cos^2 \left( \pi \frac{r}{n} \right) \right)

\left( r! \frac{1}{\pi} \right)^n \right) \right)

\end{equation}

\end{document}

Q. 5]

Type set the following expression as in-line and display mathematical text:

$\forall x \in R \exists y \in R$  such that  $y > x$ .



In-line :-

\documentclass{article}

\begin{document}

\begin{math}

\forall x \in R \exists y \in R \text{ such that } y > x

\end{math}

\end{document}

Display mathematical text :-

\documentclass{article}

\begin{document}

\begin{displaymath}

\forall x \in R \exists y \in R \text{ such that } y > x

\end{displaymath}

`\end{document}.`

Q 6) Typeset the following integral in LATEX.

$$\int_0^1 3x^2 dx = 1.$$



```
\documentclass{article}  
\begin{document}  
\begin{equation}  
 \int_{\{0\}}^{\{1\}} 3x^2 dx = 1  
\end{equation}  
\end{document}
```

Q Answer the following questions

a 1) Write a simple LATEX code for following system of equation using gather environment.

$$x = r \cos \phi \sin \theta,$$

$$y = r \sin \phi \sin \theta,$$

$$z = r \cos \theta.$$

(1)

(2)

→ \documentclass{article}

\usepackage{amsmath}

\begin{document}

\begin{gather}

$$x = r \cos \phi \cdot \sin \theta \text{ \label{E:1}}$$

$$y = r \sin \phi \cdot \sin \theta \text{ \nonumber}$$

$$z = r \cos \theta \text{ \label{E:2}}$$

\end{gather}

\end{document}

a 2) Write a simple LATEX code for following system of equation using eqnarray environment.

$$x + 2y - 2z = -11$$

$$y + z = 11$$

$$z = 21$$

(3)

→ \documentclass{article}

\begin{document}

\begin{eqnarray}

$$x + 2y - 2z &= -11 \text{ \nonumber}$$

$$y + z &= 11 \text{ \nonumber}$$

$$z &= 21 \text{ \label{E:3}}$$

\end{eqnarray}

\end{document}

Teacher's Sign:

(Q 3) write a simple LATEX code for following system of  
equation using align environment

a] .

$$\begin{aligned} x-1 &= y & (1) \\ x &= y+1 & (2) \end{aligned}$$

→

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{align}
x-1 &= y \\
x &= y+1
\end{align}
\end{document}
```

b]  $f(u) = \sum_{j=1}^n x_j f(u_j)$  (1)

$$= \sum_{j=1}^n x_j \sum_{i=1}^m a_{ij} u_i \quad (2)$$

$$= \sum_{j=1}^n \sum_{i=1}^m a_{ij} x_j u_i \quad (3)$$

→

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
```

```
\begin{align}
```

$$f(u) &= \left( \sum_{j=1}^n x_j f(u_j) \right) \\ &= \left( \sum_{j=1}^n x_j \sum_{i=1}^m a_{ij} u_i \right)$$

$$f = \left( \sum_{j=1}^n x_j \sum_{i=1}^m a_{ij} u_i \right)$$

$$f = \left( \sum_{j=1}^n x_j \left( \sum_{i=1}^m a_{ij} u_i \right) \right)$$

```
\end{align}
```

```
\end{document}
```

a. [4] Write a simple LATEX code for following system of equations using alignat environment.

(a)

m modulo m > 0

a multiplicador       $0 < a < m$

c constante auditiva  $0 \leq c < m$

$x_0$  Valor inicial  $0 \leq x_0 < m$

```

\documentclass{article}
\usepackage{amsmath}

\begin{document}
\begin{aligned}
& \text{\&m} \text{\&quad} \text{\& modulo f} \\
& \text{\&a} \text{\&quad} \text{\& Multiplic} \\
& \text{\&c} \text{\&quad} \text{\& constante l} \\
& \text{\&x\_0} \text{\&quad} \text{\& valor} \\
\end{aligned}
\end{document}

```

$$b) \quad ABC = \underline{ABC - AB} \quad (1 \cdot \bullet)$$

$$A_{BCD} = \underline{ABC - A B C D E F G}. \quad (2)$$

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{aligned}[t]
ABc4 &= ABC - AB \text{ Haber}
\end{aligned}
```

Teacher's Sign:

$\text{ABCDEF} = \text{ABC} - \text{ABCDEF} \mid \text{label}\{\text{Eq: 11}\}$

\end{alignat}

\end{document}

Q5) Write a simple LATEX code for following system of equation using left align environment

$$f(u) = \sum_{j=1}^n x_j f(u_j) \quad (1)$$

$$= \sum_{j=1}^n x_j \sum_{i=1}^m a_{ij} v_i$$

$$= \sum_{j=1}^n \sum_{i=1}^m a_{ij} x_j v_i$$

→ \documentclass{article}

\usepackage{amsmath}

\begin{document}

\begin{flalign}

$$f(u) &= \sum_{j=1}^n x_j f(u_j) \\$$

$$f = \sum_{j=1}^n x_j \sum_{i=1}^m a_{ij} v_i$$

\nonumber \\

$$f = \sum_{j=1}^n x_j \sum_{i=1}^m a_{ij} v_i$$

\nonumber \\

\end{flalign}

\end{document}

a) Write a simple LATEX code for following system of equation using sub numbering environments.

$$\begin{aligned}y &= d && (13a) \\y &= cx+d && (13b) \\y &= bx^2+cx+d && (13c) \\y &= ax^3+bx^2+cx+d && (13d)\end{aligned}$$

→

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{subequations}
\begin{equation}
y = d \quad \text{label} \{ eq|13a \}
\end{equation}
\begin{equation}
y = cx + d \quad \text{label} \{ eq|13b \}
\end{equation}
\begin{equation}
y = bx^2 + cx + d \quad \text{label} \{ eq|13c \}
\end{equation}
\begin{equation}
y = ax^3 + bx^2 + cx + d \quad \text{label} \{ eq|13d \}
\end{equation}
\end{subequations}
\end{document}
```

## 6. Text and Blank space in math-mode

Q. Answer the following questions

Q. 1) What are the commands used for text spacing and blank space in LATEX?

→ commands used for text spacing :-

`\mbox{}`,

`\text{}`,

`\intertext{}`,

and `\mathrm{}` are used command.

Command used for Blank space =

`\sim`, `\quad`, `\quad\quad`, `\enspace` & `\hspace{}` can be used in blank space of different sizes.

Q. 2) Write a following equations in LATEX using spacing rule

$$F(x) = x^3 - 4x^2 + 5x + 10$$

$$F(x) = x^3 - 4x^2 + 5x + 10$$

$$F(x) = x^3 - 4x^2 + 5x + 10$$

$$f(x) = x^3 - 4x^2 + 5x + 10$$

$$f(x) = x^3 - 4x^2 + 5x + 10$$

$$F(x) = x^3 - 4x^2 + 5x + 10$$

$$F(x) = x^3 - 4x^2 + 5x + 10$$

$$F(x) = x^3 - 4x^2 + 5x + 10$$

$$F(x) = x^3 - 4x^2 + 5x + 10$$

→

`\documentclass{article}`

`\usepackage{amsmath}`

`\begin{document}`

Q. 37 Write a LaTeX code for the following texts in math-mode.

environment  $S = \{z \in \mathbb{C} \mid |z| < 1\}^+$  and  $s_1 = 2S$ .

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{equation*}
S = \{z \mid z \in C \quad |z| < 1\}
\end{equation*}
\end{document}
```

Q.4) Write a Latex code for following texts in math-mode-text environment

$$\lim_{x \rightarrow \infty} e^{kx} = 0 \quad \text{if } k > 0 \quad (1)$$

→ \begin{document} \begin{equation}

\*  $\lim_{x \rightarrow \infty} e^{-kx} = 0$  {quad if quad  
 $k > 0$ }  
\end{equation}  
\end{document}.

Q.5 Write a LATEX code for following texts in math-mode environment

→ Updated value  $x = x^{low} + yd$

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
\begin{equation*}
\boxed{\text{updated value}} \quad x = x^{\text{low}} + yd
\end{equation*}
\end{document}
```

Q.6) Write a LATEX code for the following text in math-mode environment

maximize  $f(x)$

subject to  $g_i(x) \leq 0 ; i = 1, \dots, m$

$h_k(x) = 0 ; k = 1, \dots, p$

$x_j \geq 0 ; j = 1, \dots, n$

→

```
\documentclass{article}
```

```
\usepackage{amsmath}
```

```
\begin{document}
```

```
\begin{equation*}
```

```
\begin{array}{l}
\boxed{\text{maximize}}

```

```
+ f(\boxed{\boldsymbol{x}}) \\
```

```
\boxed{\text{subject to}}
```

```
+ g-i(\boxed{\boldsymbol{x}}) \leq 0 ; & i=1, \dots, m
```

```
+ h-k(\boxed{\boldsymbol{x}}) = 0 ; & k=1, \dots, p
```

```
+ x-j \geq 0 ; & j=1, \dots, n
```

```
\end{array}, \end{equation*}, \end{document}
```