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## MATHS

## BOOKS - CENGAGE MATHS (ENGLISH)

## GETTING STARTED WITH GRAPHS

## Illustration 11

1. Does the following graph represent a function or a relation?


## Illustration 12

1. Does the graph below represent a function or a relation?
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## D View Text Solution

## Illustration 13

1. Does the following graph pass the vertical or horizontal line test?


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Illustration 14

1. In how many points graph of $y=x^{3}-3 x^{2}+5 x-3$ interest the $x$-axis?

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1. Following is the graph of $y=f(x)$.


Find the
roots
of
the
equation
$f(x)=0, f(x)=4$ and $f(x)=10$.

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1. Which of the following pair of graphs intersect ?
(i) $\mathrm{y}=x^{2}-x$ and $\mathrm{y}=1$
(ii) $\mathrm{y}=x^{2}-2 x+3$ and $\mathrm{y}=\sin \mathrm{x}$
(iii) $=x^{2}-x+1$ and $y=x-4$

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## Illustration 17

1. The graph of $y=f(x)$ is shown, find the number of solution of $f(f(x))=2$.


## Illustration 18

1. Does the graph of the function $f(x)=x^{2}-3$ have y - axis symmetry?

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## Illustration 19

1. Does the graph of the function $f(x)=1 / x^{3}$ have origin symmetry?

## Illustration 110

1. Check whether the function has (have) $y$-symmetry or origin symmetry: $f(x)=x^{2} \sin x$.

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## Illustration 111

1. Let $f: R \rightarrow R$ be a continuous onto function satisfying $f(x)+f(-x)=0, \forall x \in R$. If $f(-3)=2$ and $f(5)=4$ in
$[-5,5]$, then what is the minimum number of roots of the equation $f(x)=0$ ?

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## Illustration 112

1. Let $f: R \rightarrow R$ and $g: R \rightarrow R$ be two one-one and onto functions such that they are mirror images of each other about the line $y=a$. If $h(x)=f(x)+g(x)$, then $h(x)$ is (A) one-one onto (B) one-one into (C) many-one into (D) many-one onto

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## Illustration 113

1. Check weather the following function/functions is/are periodic or not? Find the period in case the function is periodic.
(a)

(b)

(c)

(d)

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## Illustration 114

$$
\begin{aligned}
& \text { 1. } \left.\begin{array}{c}
\text { Draw } \\
f(x)=\{(x-2 n, 2 n \leq x<2 n+1), \\
\\
\text { the }
\end{array} \frac{1}{2}, 2 n+1 \leq x<2 n+2\right)
\end{aligned}
$$

periodic? If yes, what is its period?

## Illustration 115

1. The graph of $y=f(x)$ is as shown in the following figure.

Find the following values:
(i) $\lim _{x \rightarrow 4} f(x)$
(ii) $\lim _{x \rightarrow-3} f(x)$
(iii) $\lim f(x)$
(iv) $f(x)$
$x \rightarrow 0^{-}$
$(v) \lim _{x \rightarrow 0} f(x)$
$(v i) f(-2)$
(vii) $\lim _{x \rightarrow 2^{-}} f(x)$
(viii) $\lim _{x \rightarrow-2^{-}} f(x)$
(ix) $\lim _{x \rightarrow 0} f(x+1)$
$(x) f(0)$
$(x i) \lim _{x \rightarrow 0^{+}} f(x-2)$
$(x i i) \lim _{x \rightarrow 1^{-}} f(x-4)$

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1. The graph of $y=f(x)$ is as shown in the following figure.


Identify the points of discontinuity and give the reason for the same.

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## Illustration 117

1. The graph of $f(x)$ is given. State with reasons the number at which the function is non-differentiable.


## Illustration 118

1. For each of the following graphs, comment whether $f(x)$ is increasing or decreasing or neither increasing nor decreasing at $x$
$=a$.

(ii)

(iv)


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1. The graph of a function is shown in the following figure.


Determine the intervals on which the function is concave up and the intervals on which it is concave down. Find the x - coordinates of any inflection points.

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## Illustration 120

1. For the function $g$ whose graph is given. Arrange the following numbers in increasing order and explain your reasoning.

$$
g(0), g^{\prime}(-2), g^{\prime}(0), g^{\prime}(2), g^{\prime}(4)
$$



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## Illustration 121

1. The diagram shows the graph of the derivative of a functin $f(x)$ for $0 \leq x \leq 4$ with $\mathrm{f}(0)=0$. Which of the following could be
correct statements for $\mathrm{y}=\mathrm{f}(\mathrm{x})$ ?

(a) Tangent line to $y=f(x)$ at $x=0$ makes an angle of $\sec ^{-1} \sqrt{5}$ with the x -axis.
(b) $f$ is increasing in ( 0,3 ).
(c) $x=1$ is both an inflection point and the point of local extremum.
(d) Number of critical point on $y=f(x)$ is two.

## Illustration 122

1. In the following graph, state the absolute and local maximum and minimum values of the function.


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## Illustration 123

1. The graph of the derivative $f^{\prime}(x)$ is given in the following figure.
(b) Find the values of $x$ for which $f$ has local maximum or

## minimum.

(c) Find the intervals in which f is concave upward or downward.
(d) Find the point of inflection.


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## Illustration 124

1. The graph of the second derivation $f^{\prime \prime}(x)$ is given in the following figure. State the x -coordinate of the point of inflection
of f. Given reasons for your answer.


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## Illustration 125

1. The figure shows the graphs of $f, f^{\prime}$ and $\mathrm{f}^{\prime \prime}$. Identify each curve and explain your choices.
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2. Following is the graph of $y=f^{\prime}(x)$, given that $f(c)=0$. Analyse the graph and answer the following questions.
(a) How many times the graph of $y=f(x)$ will intersect the $x$ - axis?
(b) Discuss the type of roots of the equation $\mathrm{f}(\mathrm{x})=0, a \leq x \leq b$.
(c) How many points of inflection the graph of $y=f(x), a \leq x \leq b$, has?
(d) Find the points of local maxima/minima of $y=f(x), a<x b$.
(e) How many roots equation $f^{\prime \prime}(x)=0$ has?


## Illustration 127

1. Find the asymptote of the function $y=\frac{2 x^{2}+3 x+1}{x}$ if any.

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## Illustration 128

1. Find the horizontal, vertical and oblique asymptotes of each of the curves.
(a) $y=\frac{x}{x+4}$
(b) $y=\frac{x^{2}+4}{x^{2}-1}$
(c) $y=\frac{x^{3}}{x^{2}+3 x-10}$
(d) $y=\frac{x^{3}+1}{x^{3}+x}$
(e) $y=\frac{x}{\sqrt[4]{x^{4}+1}}$
(f) $\quad y=\frac{x-9}{\sqrt{4 x^{2}+3 x+2}}$
(g) $y=\frac{1}{2^{x}-1}$
(h) $y=\frac{1}{\log _{e} x}$
(i) $y=\frac{1}{2^{x}-1}$

## Exercises 11

1. Does the following graph pass the vertical or horizontal line test?


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1. Consider the graph of $y=f(x)$ as shown in the following figure.

(i) Find the sum of the roots of the equation $f(x)=0$.
(ii) Find the product of the roots of the equation $f(x)=4$.
(iii) Find the absolute value of the difference of the roots of the equation $f(x)=x+2$.

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## Exercises 13

1. Determine whether the function has $y$-symmetry or origin symmetry: $f(x)=\frac{x}{e^{x}-1}+\frac{x}{2}+1$

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## Exercises 14

1. The graph of functions are given in the following fingure.

Discuss the symmetry.
(a)

(b)


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## Exercises 15

1. Check weather the following function/functions is/are periodic or not? Find the period in case the function is periodic.
(i)

(b)

(c)


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## Exercises 16

1. Suppose that $f$ is even, periodic function with period 2 , and that $f(x)=x$ for all $x$ in the interval $[0,1]$. Then draw the graph of $y=$ $f(x)$.
2. The graph of $y=f(x)$ is as shown in the following figure.


Find the following values
(i) $f(-3)$
(ii) $f(-2)$
(iii)f(0)
(iv) $f(2)$
$(v) f(3)$
(vi) $\lim _{x \rightarrow-3} f(x)$
(vii) $\lim _{x \rightarrow 0} f(x)$
(viii) $\lim _{x \rightarrow 2} f(x)$
$(i x) \lim _{x \rightarrow 3} f(x)$
$(x) \lim _{x \rightarrow 2^{-}} f(x)$
( $\xi$ ) $\lim _{x \rightarrow-2^{+}} f(x)$
(xii) $\lim _{x \rightarrow 0^{-}} f(x)$
(x iii) $\lim _{x \rightarrow 0^{+}} f(x)$

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## Exercises 18

1. The graph of f is shown. State, with reason, the numbers at which f is not differentiable.


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1. Select the right option regarding the given graph.


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## Exercises 110

1. (a) Can the graph of the function intersect the horizontal asymptote?
(b) Can the graph of the function intersect the vertical asymptote?

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## Exercises 111

1. The graph of $y=f(x)$ is given with six labelled points. Anser the following questions.
(a) At which point $f^{\prime}(x)$ has the greatest value?
(b) At which point $f(x)$ and $f^{\prime}(x)$ both are zero?
(c) At how many point $f^{\prime}(x)$ is negative ?
(d) Which is the point of infection?


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## Exercises 112

1. Graph of functions are given in the following figure. Check the functions for absolute extremum.


(c)


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## Exercises 113

1. Given the graph of the function $y=f(x)$, draw the graph of
$y=\operatorname{sgn}(x)$.


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Exercises 114

1. Find the intervals in which $f(x)=x^{2}+2 x-5$ is increasing or decreasing.

## Exercises 115

1. Find all the points of local maxima and local minima of the function $f(x)=x^{3}-6 x^{2}+12 x-8$.

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## Exercises 116

1. The figure shows the graphs of $f, f^{\prime}$ and $f$ ". Indentify each curve and explain your choices.


## Exercises 117

1. Match the graph of $y=f(x)$ in Column I with the corresponding graph of $y=f^{\prime}(x)$ in Column II.



## Exercises 118

1. Following is the graph of $y=f^{\prime}(x)$ and $f(0)=0$.

(a) What type of function $y=f^{\prime}(x)$ is ? Odd or even?
(b) What type of function $\mathrm{y}=\mathrm{f}(\mathrm{x})$ is ? Odd or even?
(c) What is the value of $\int_{-a}^{a} f(x) d x$ ?
(d) Has $y=f(x)$ point of inflection?
(e) What is the nature of $y=f(x)$ ? Monotonic or non-monotonic?
