



MATHS

BOOKS - CENGAGE MATHS (ENGLISH)

GRAPHS OF POLYNOMIAL AND RATIONAL FUNCTIONS



1. Draw the rough sketch of the curve $y = (x-1)^2(x-3)^3$.

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2. Draw the rough sketch of the curve $y = (x-1)^2(x-2)(x-3)^3$.





6. Draw the graph of $y = x^3 - x^2 + x - 2$ and find the number of real root(s) of the equation $x^3 - x^2 + x - 2 = 0$. Also locate the root.

7. Sketch the graph of the following functions y = f(x) and find the number of real roots of the corresponding equation f(x) = 0.

 $(i)f(x)=2x^3-9x^2+12x-(9/2)$ $(ii)f(x)=2x^3-9x^2+12x-3$



8. Draw the graph of $y = x^4 + 2x^2 - 8x + 3$

Find the number of real roots of the equation $x^4 + 2x^2 - 8x + 3 = 0$.

Also find the sum of the integral parts of all real roots.

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- 9. Let a $\,\in\,$ R and f :R
 ightarrow R be given by $f(x)=x^5-5x+a$, then
- (a) f(x) = 0 has three real roots if a > 4
- (b) f(x) = 0 has only one real root if a > 4
- (c) f(x) = 0 has three real roots if a < -4
- (d) f(x) = 0 has three real roots if -4 < a < 4



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11. Find the area bounded by the curves $y = \sqrt{1 - x^2}$ and $y = x^3 - x$ without using integration.

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12. Draw the graph of $f(x) = 4x^3 - 3x$ and hence draw the graph of

$$g(x) = \cos^{-1}(4x^3 - 3x).$$



13. Let
$$f(x)=1+4x-x^2, \ orall x\in R$$

 $g(x) = \; \max \; \{f(t), x \leq t \leq (x+1), 0 \leq x < 3\} = \; \min \; \{(x+3), 3 \leq x \;$

Verify conntinuity of g(x), for all $x \in [0,5]$

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14. Find the value of k if $x^3 - 3x + a = 0$ has three real distinct roots.

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15. If t is a real number satisfying the equation $2t^3 - 9t^2 + 30 - a = 0$, then find the values of the parameter a for which the equation $x + \frac{1}{x} = t$ gives six real and distinct values of x.

16. Let $f(x)=x^3-9x^2+24x+c=0$ have three real and distinct roots lpha, eta and $\lambda.$

(i) Find the possible values of c.

(ii) If $[\alpha] + [\beta] + [\lambda] = 8$, then find the values of c, where $[\cdot]$ represents the greatest integer function.

(ii) If $[lpha]+[eta]+[\lambda]=$ 7, then find the values of c, where $[\ \cdot\]$ represents

the greatest integer function.s

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17. Draw the graph of
$$f(x)=rac{x^2-x+1}{x^2+x+1}$$
 .

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18. Draw the graph of $y=rac{x-1}{x^2}$ and hence the graph of $y=rac{|x-1|}{x^2}.$

19. Write a possible rational function f that has a vertical asymptote at x = 2, a horizontal asymptote y = 3 and a zero at x = -5. Also draw the graph of the function.

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21. Draw the graph of
$$y=f(x)=rac{x+1}{x^2+1}$$



23. Draw the graph of
$$f(x)=rac{1}{x^2-2x+2}$$

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24. From the graph of
$$y=x^2-4$$
, draw the graph of $y=rac{1}{x^2-4}.$

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25. Draw the graph of
$$y=x^2+rac{1}{x^2}, x
eq 0.$$

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26. Draw the graph of
$$f(x) = \left|rac{x^2-2}{x^2-1}
ight|$$

27. Draw the graph of $y=rac{1-x^2}{1+x^2}$ and hence draw the graph of $y=\cos^{-1}\cdot rac{1-x^2}{1+x^2}.$

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28. Write a rational function f with a slant asymptote y = x + 4, a vertical asymptote at x = 5 and one of the zeros at x = 2.



30. Draw the graph of
$$y = an^{-1} igg(rac{3x-x^3}{1-3x^2} igg).$$



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32. Draw the graph of
$$y = rac{1}{x} + rac{1}{x-2}.$$

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33. Find the greatest value of
$$f(x)rac{1}{2ax-x^2-5a^2}\in [-3,5]$$

depending upon the parameter a.

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Exercises

1. Draw the graph of
$$y=(x-1)ig(x^2-x+1ig).$$





3. Let P and Q be any two points. Find the coordinates of the point R which divides PQ externally in the ratio 2:1 and verify that Q is the mid point of PR.

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- 4. Draw the graphs of
- (i) $y = x^2(x-1)|x-2|$
- (ii) $y = x^3(x-1)|x-2|$

5. Write a possible rational function f that has a vertical asymptote at x = 2, a horizontal asymptote y = 3 and a zero at x = -5. Also draw the graph of the function.

6. Draw the graph of
$$y=f(x)=rac{x^2}{x^2+1}.$$

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7. Draw graph of
$$y=rac{x^2-6x+4}{x^2+2x+4}.$$

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8. Draw the graph of
$$f(x)=rac{x^2-8x+15}{x^2-2x}$$

9. Draw the graph of $f(x)=rac{5x^2}{\left(x-1
ight)^3}.$

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10. Draw the graph of
$$f(x)=rac{2|x-1|}{x^2+1}.$$

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11. Draw the graph of
$$y=rac{1}{x+1}+rac{1}{x}+rac{1}{x-2}.$$

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12. Draw the graph of
$$y = x + rac{1}{x}$$

13. Draw the graph of $y=rac{(x+6)(x+2)x(x-2)}{(x-3)(x^2-x+1)}.$

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14. Draw graph of
$$y = rac{1}{x^2} - x.$$

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15. Draw graph of
$$y=rac{x^3-2x^2}{3(x+1)^2}.$$

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16. Draw graph of
$$y=rac{x^3-5x}{x^2+1}$$
 .

17. Given $C_1 < C_2 < C_3 < C_4 < C_5$ and the function y = f(x) is twice differentiable .

f'(x) > 0 for $x \in (C_2, C_4)$, $f'(C_2) = f'(C_4) = 0$ and f'(x) < 0 for all the remaining values. Also $f''(C_1) = f''(C_3) = f''(C_5) = 0$ and f''(x) > 0 for $x \in (C_1, C_3) \cup (C_5, \infty)$ and f''(x) < 0 for remaining values. Answer the following:

(i) What is the minimum number of asymptotes parallel to the x-axis for y=f(x)?

(ii) What is the maximum number of asymptotes parallel to the x-axis of y = f(x) ?

(iii) If the range of y = f(x) is $[a, b], a, b \in R$, then what is the minimum number of asymptotes parallel to the x-axis of y = f(x)? (iv) If the range of y = f(x) is non-finite interval, then what is the maximum number of asymptotes parallel to the x-axis ?