

## TANGENT &amp; NORMAL

## Answer Ex-I

## SINGLE CORRECT (OBJECTIVE QUESTIONS)

- |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. B  | 2. A  | 3. B  | 4. D  | 5. C  | 6. B  | 7. A  | 8. A  |
| 9. A  | 10. B | 11. B | 12. D | 13. B | 14. D | 15. B | 16. B |
| 17. B | 18. B | 19. A | 20. B | 21. A | 22. B | 23. B | 24. B |
| 25. B | 26. B | 27. B | 28. A | 29. B | 30. A |       |       |

## Answer Ex-II

## MULTIPLE CORRECT (OBJECTIVE QUESTIONS)

- |       |        |        |        |        |         |        |       |
|-------|--------|--------|--------|--------|---------|--------|-------|
| 1. AC | 2. AB  | 3. AD  | 4. ABD | 5. AB  | 6. AC   | 7. ABC | 8. AB |
| 9. AC | 10. AC | 11. AD | 12. AB | 13. BC | 14. ACD | 15. AC |       |

## Answer Ex-III

## SUBJECTIVE QUESTIONS

- |                          |                             |   |
|--------------------------|-----------------------------|---|
| 1. (0, 0) ; (3, 27)      | 2. $2x + y = 2$             | 3. Tangent : $x + y = 6$ , Normal $x - y = 0$ |
| 4. $y = x$               | 5. (a) $y - 2x - 3 = 0$     | (b) $2x + y - 7 = 0$                          |
| 8. (4, 11) & (-4, -31/3) | 9. (0, 0), (1, 2), (-1, -2) | 10. (9/4, 3/8)                                |
| 11. $\frac{\pi}{3}$      |                             |   |
| 12. $3\sqrt{2} - 1$      | 13. (-6, 3)                 | 15. (i) -2 cm/min                             |
|                          |                             | (ii) 2 cm <sup>2</sup> /min                   |
| 16. zero                 | 17. -1                      | 18. -1500 ft/sec                              |
|                          |                             | 19. $\pm \frac{c}{\sqrt{2}}$                  |
| 20. $p \in (0, 1/e)$     | 21. 8                       | 22. $a \in \left(-\frac{13}{4}, 3\right)$     |
|                          |                             | 23. $\frac{8b}{27}$                           |

## Answer Ex-IV

## ADVANCED SUBJECTIVE QUESTIONS

- |   |  |
|---|--|
| 1. (0, 1)   | 2. $x = 1$ when $t = 1$ , $m \rightarrow \infty$ ; $5x - 4y = 1$ if $t \neq 1$ , $m = 1/3$ |
| 3. T : $x - 2y = 0$ ; N : $2x + y = 0$                            | 4. $x + 2y = \pi/2$ & $x + 2y = -3\pi/2$   |
| 10. $\frac{m\sqrt{m}}{\sqrt{2}}$                                  |  |
| 11. (a) $n = -2$  | 12. $\pm \frac{1}{2\sqrt{2}}$  |
| 13. (i) 6 km/h  | (ii) 2 km/hr   |
| 14. $1 + 36\pi$ cu. cm/sec  |  |
| 15. $1/48 \pi$ cm/s   | 16. 0.05 cm/sec  |
| 17. $\frac{66}{7}$  | 18. $\frac{1}{4}$ cm/sec.  |
| 19. (a) $-\frac{1}{24\pi}$ m/min., (b) $-\frac{5}{288\pi}$ m/min. | 20. (a) $r = (1 + t)^{1/4}$ , (b) $t = 80$   |

## Answer Ex-V

## JEE PROBLEMS

- |   |      |      |      |      |
|---|------|------|------|------|
| 1. $\sqrt{2}x + y - 2\sqrt{2} = 0$ or $\sqrt{2}x - y - 2\sqrt{2} = 0$ | 2. D | 3. D | 4. D | 5. A |
|---|------|------|------|------|

# MONOTONOCITY

## Answer Ex-I

## SINGLE CORRECT (OBJECTIVE QUESTIONS)

- |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. C  | 2. C  | 3. A  | 4. B  | 5. D  | 6. B  | 7. D  | 8. C  |
| 9. D  | 10. A | 11. C | 12. D | 13. B | 14. C | 15. D | 16. C |
| 17. B | 18. C | 19. A | 20. B | 21. B | 22. B | 23. D | 24. B |
| 25. A | 26. B | 27. D | 28. D | 29. C | 30. B | 31. A | 32. B |
| 33. B | 34. B | 35. C | 36. D | 37. D | 38. A |       |       |

## Answer Ex-II

## MULTIPLE CORRECT (OBJECTIVE QUESTIONS)

- |        |        |        |        |        |        |          |
|--------|--------|--------|--------|--------|--------|----------|
| 1. AB  | 2. BC  | 3. AD  | 4. BC  | 5. BC  | 6. ABC | 7. ACD   |
| 8. AD  | 9. AB  | 10. AD | 11. AB | 12. AD | 13. AC | 14. ABCD |
| 15. AB | 16. CD | 17. AB | 18. AC |        |        |          |

## Answer Ex-III

## SUBJECTIVE QUESTIONS

1.  $a \in \mathbb{R}^+$       3.  $[1 - \sqrt{6}, 1 + \sqrt{6}]$
4. (i) M.D. in  $(-\infty, -3] \cup [0, 2]$       M.I. in  $(-3, 0] \cup [2, \infty)$
- (ii) M.I. in  $\left[\frac{2}{4n+3}, \frac{2}{4n+1}\right], n \in \mathbb{Z}$       M.D. in  $\left[\frac{2}{4n+1}, \frac{2}{4n-1}\right], n \in \mathbb{Z}$
- (iii) M.D. in  $\left(0, \frac{1}{\sqrt{3}}\right]$       M.I. in  $\left[\frac{1}{\sqrt{3}}, \infty\right)$
5.  $(-\infty, -3]$       6.  $(\pi/6) + (1/2) \cdot \ln 3, (\pi/3) - (1/2) \ln 3$       10.  $2 \sin x + \tan x > 3x$ , limit = 0
11.  $[\sqrt{5}, \sqrt{10}]$       12.  $f(x)$  is injective  $\forall x \in [0, \infty)$
14. increasig when  $x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$       decreasin when  $x \in \left(0, \frac{\pi}{4}\right)$ .
16.  $a < -(2 + \sqrt{5})$  or  $a > \sqrt{5}$       17.  $(-\infty, -2) \cup (0, \infty)$       18.  $\ln(1+x)$
20. Neither increasing nor decreasing at  $x = -1$ , increasing at  $x = 0, 1$ .
21.  $[1, \infty)$       24.  $[-7, -1] \cup [2, 3]$

26. (a) I in  $(2, \infty)$  & D in  $(-\infty, 2)$  (b) I in  $(1, \infty)$  & D in  $(-\infty, 0) \cup (0, 1)$   
 (c) I in  $(0, 2)$  & D in  $(-\infty, 2) \cup (2, \infty)$  (d) I for  $x > \frac{1}{2}$  or  $-\frac{1}{2} < x < 0$  & D for  $x < -\frac{1}{2}$  or  $0 < x < \frac{1}{2}$
27.  $(-2, 0) \cup (2, \infty)$
28. (a) I in  $[0, 3\pi/4) \cup (7\pi/4, 2\pi]$  & D in  $(3\pi/4, 7\pi/4)$   
 (b) I in  $[0, \pi/6) \cup (\pi/2, 5\pi/6) \cup (3\pi/2, 2\pi]$  & D in  $(\pi/6, \pi/2) \cup (5\pi/6, 3\pi/2)$   
 (c) I in  $[0, \pi/2) \cup (3\pi/2, 2\pi)$  & D in  $(\pi/2, 3\pi/2)$
29. continuous but not diff. at  $x = 1$
30. (a) Maximum at  $x = 1$  and  $f(-1) = 18$ ; Minimum at  $x = 1/8$  and  $f(1/8) = -9/4$   
 (b) 2 & -10
31.  $a \in (-\infty, -3] \cup [1, \infty)$  32.  $0 \leq a \leq \frac{3}{2}$  33.  $\uparrow$  in  $(3, \infty)$  and  $\downarrow$  in  $(1, 3)$
34.  $a \geq 0$
35. (a)  $(-\infty, 0]$  (b)  $\uparrow$  in  $\left(1, \frac{5}{3}\right)$  and  $\downarrow$  in  $(-\infty, 1) \cup \left(\frac{5}{3}, \infty\right) - \{-3\}$  (c)  $x = \frac{5}{3}$   
 (d) removable discontinuity at  $x = -3$  (missing point) and non removable discontinuity at  $x = 1$  (infinite type)  
 (e) -2
38.  $(-1, 0) \cup (0, \infty)$  39.  $(b - a)^{3/4}$

**Answer Ex-IV****ADVANCED SUBJECTIVE QUESTIONS**

11.  $c = \frac{mb + na}{m + n}$  which lies between  $n$  &  $b$  16.  $a = 3, b = 4$  and  $m = 1$
17.  $y = -5x - 9$  and  $y = 5x + 11$ .

**Answer Ex-V****JEE PROBLEMS**

1. (a) B ; (b) D ; (c) C 2. (a) A, (b)  $\cos\left(\frac{1}{3}\cos^{-1}p\right)$  3. A 5. (a) D; (b) C
7. D 8. (a) B; (b) (i) B, (ii) A, (iii) A; (c) (A)-P, Q, R ; (B)-P, S ; (C)-R, S ; (D)-P, Q
9. (a) C, (b) A, B, C, D 10. B, C, D 11. B, C 12. B 13. C

## MAXIMA &amp; MINIMA

## Answer Ex-I

## SINGLE CORRECT (OBJECTIVE QUESTIONS)

- |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. C  | 2. D  | 3. C  | 4. D  | 5. A  | 6. C  | 7. B  | 8. A  |
| 9. D  | 10. D | 11. C | 12. A | 13. A | 14. B | 15. D | 16. C |
| 17. A | 18. B | 19. C | 20. C | 21. B | 22. A | 23. B | 24. D |
| 25. D | 26. D | 27. A | 28. B | 29. C | 30. B | 31. C | 32. C |
| 33. A | 34. D | 35. A | 36. B | 37. D | 38. A | 39. B | 40. C |
| 41. A | 42. C | 43. A | 44. B | 45. A | 46. B | 47. D | 48. C |
| 49. A | 50. D | 51. C | 52. B | 53. D |       |       |       |

## Answer Ex-II

## MULTIPLE CORRECT (OBJECTIVE QUESTIONS)

- |        |        |         |        |        |         |        |         |
|--------|--------|---------|--------|--------|---------|--------|---------|
| 1. D   | 2. ACD | 3. B    | 4. ACD | 5. AC  | 6. BD   | 7. AC  | 8. BD   |
| 9. AC  | 10. AD | 11. AC  | 12. AC | 13. AC | 14. ABD | 15. BC | 16. ACD |
| 17. BC | 18. AC | 19. ACD |        |        |         |        |         |

## Answer Ex-III

## SUBJECTIVE QUESTIONS

1. (i) maxima (ii) minima (iii) neither maxima nor minima (iv) neither maxima nor minima  
(v) neither maxima nor minima (vi) maxima 2.  $a = b = 3$
3. (i) local max at  $x = 1$ , local min at  $x = 6$  (ii) local max. at  $x = -1/5$ , local min. at  $x = -1$   
(iii) local minima at  $x = \frac{1}{e}$ , No local maxima 4. minima at  $x = 0$
5. (i) 3 points,  $x = 0, -3, -5$  (ii)  $\infty$  points,  $x \in [-1, 2]$  (iii) 2 points,  $x = \frac{\pi}{4}, \frac{3\pi}{4}$
6. local max. at  $x = 1$ , local min. at  $x = 2$
7. (i) max. = 8, min. = -8 (ii) max. =  $\sqrt{2}$ , min. = -1 (iii) max. = 8, min. = -10  
(iv) max. = 25, min. = -39 (v) max. at  $x = \pi/6$ , max. value =  $3/4$ ; min. at  $x = 0$  &  $\pi/2$ , min. value =  $1/2$
9. Greatest and least values are not defined 10.  $b \in (0, e]$
11. (i) local max. at  $x = -1$ , Maxima of  $f(x) = -2$ , local min. at  $x = 1$ , Minima of  $f(x) = 2$   
(ii) Local Minima at  $x = \frac{\pi}{2} + 2n\pi$ ,  $n \in I$ , Minima of  $f(x) = 1$ ,  
Local Maxima at  $x = -\frac{\pi}{2} + 2n\pi$ ,  $n \in I$ , Maxima of  $f(x) = -1$
12. It is a global maxima. 14.  $\frac{80\pi}{\pi+4}, \frac{20\pi}{\pi+4}$  17. 12cm, 6 cm 18. 40 mph
19.  $27\sqrt{3}$  sq. cms. 20. width  $2\sqrt{3}$  m, length  $3\sqrt{3}$  m 22.  $\left(\frac{1}{2}, \frac{5}{4}\right)$
23.  $f(x) = 2x^4 - \frac{12}{5}x^5 + \frac{2}{3}x^6$  24.  $\frac{4\pi r^2}{3\sqrt{3}}$  25. Rs. 400 26. 5 km. from B towards A
27.  $\cos A = 0.8$  28.  $\frac{4\sqrt{3}}{9}$  29.  $2\pi/3$  30. side 10', height 10'
31. Global maximum  $\frac{\pi}{6} + \frac{1}{4} \ln 3$ , Global minima  $\frac{\pi}{3} - \frac{1}{4} \ln 3$  32.  $\frac{3\sqrt{3}}{8} a^2$



**Answer Ex-IV****ADVANCED SUBJECTIVE QUESTIONS**

1.  $f(x) = x^3 + x^2 - x + 2$       2. (a) Max. at  $x = 2\pi$ , Max. value =  $2\pi$ , Min. at  $x = 0$ , Min. value of = 0  
(b) Max. at  $x = \pi/6$  & also at  $x = 5\pi/6$  and Max. value =  $3/2$ , Min. at  $x = \pi/2$ , Min. value =  $-3$
3.  $f(x) = \frac{2}{3}x^6 - \frac{12}{5}x^5 + 2x^4$       4.  $P_{\max.} = a \left(1 + \operatorname{cosec} \frac{\alpha}{2}\right)$       5.  $75\sqrt{3}$  sq. units.
6.  $r = \sqrt{\frac{2A}{\pi+4}}$ ,  $s = \sqrt{\frac{2A}{\pi+4}}$       8.  $3x + 4y - 9 = 0$ ;  $3x - 4y + 9 = 0$       9.  $4\sqrt{2}$  m
10.  $1/\pi$  cu m      11.  $110', 70'$       12. side  $10'$ , height  $10'$       13. 32 sq. units      14.  $\theta = 60^\circ$
15.  $a = 1$ ,  $b = 0$       17. width  $2\sqrt{3}$  m, length  $3\sqrt{3}$  m      18.  $|a - b|$
19. (a)  $(-1, 0)$ ,  $(0, 5/6)$       (b)  $F'(x) = (x^2 - x)$ ,  $F''(x) = 2x - 1$   
(c) increasing  $(-\infty, 0) \cup (1, \infty)$  decreasing  $(0, 1)$ ; (d)  $(0, 5/6)$ ;  $(1, 2/3)$ ; (e)  $x = 1/2$
20. (a)  $x = y = \frac{d}{\sqrt{2}}$  (b)  $x = \frac{d}{\sqrt{3}}$ ,  $y = \sqrt{\frac{2}{3}}d$       21.  $6' \times 18'$       22.  $r = \sqrt{A}$ ,  $\theta = 2$  radians
23. (a) 0, 3      (c)  $\frac{3}{4}$ ,  $t = \ln 4$       24.  $\cos A = 0.8$       26.  $(0, 0)$
28.  $p < a < \frac{32p^3}{27} + p$  if  $p > 0$ ;  $\frac{32p^3}{27} + p < a < p$  if  $p < 0$       30. 4 when  $a = \sqrt{2}$
31. (a)  $f$  is continuous at  $x = 0$  (b)  $-\frac{2}{e}$  (c) does not exist, does not exist; (d) point of inflection  $x = 1$
32. (a)  $x = -2\pi, -\pi, 0, \pi, 2\pi$  (b) no inflection point (c) maxima at  $x = \frac{\pi}{2}$  and  $-\frac{3\pi}{2}$  and no minima,  
(d)  $x = \frac{3\pi}{2}$  and  $x = -\frac{\pi}{2}$ , (e)  $-\pi \ln 2$       33. 4      34.  $m \in \left(\frac{1}{32}, \frac{1}{16}\right)$       35.  $\frac{\pi}{4}$
36. 320      37.  $H = x = \left(\frac{4V}{\sqrt{3}}\right)^{1/3}$       38.  $L/4$       39.  $\frac{\pi}{3}$
40. (a) increasing in  $(0, 2)$  and decreasing in  $(-\infty, 0) \cup (2, \infty)$ , local min. value = 0 local max. value = 2  
(b) concave up for  $(-\infty, 2 - \sqrt{2}) \cup (2 + \sqrt{2}, \infty)$  and concave down in  $(2 - \sqrt{2}, 2 + \sqrt{2})$   
(e)  $f(x) = \frac{1}{2}e^{2x} \cdot x^2$

**Answer Ex-V****JEE PROBLEMS**

1. A      2.  $2ab$       3. (a) D; (b) A      4. A      5. (a)  $(2, 1)$ ; (b) 5      6. (a) D      7.  $4\sqrt{65}$
8. (a) B, C; (b) A (c) 6 solutions      9. (a) C; (b) (i) A, (ii) A, (iii) B      10. (a) 0; (b) 7
11. (a) D, (b) 1      12. 2      13. 9      14. 5      15. A, B, C, D