Instructions for Solving the DPP (Daily Practice Problems)

1. Purpose of the DPP

- This DPP is designed to strengthen concept clarity for both **JEE Main** and **JEE Advanced**.
- Problems are arranged in increasing order of difficulty:
  - **Level–1**: JEE Main oriented
  - **Level–2**: Mixed Main + Advanced
  - **Level–3**: JEE Advanced oriented

2. How to Attempt the DPP

1. Read the theory from your notes before attempting the problems.
2. Do not jump between questions; solve sequentially unless instructed otherwise.
3. For each question, write:
   - Key concept involved
   - Formula used
   - Corrected approach if you made an error
4. Maintain a separate **DPP Mistake Notebook**.

3. Recommended Time Allocation

- Total time per DPP: **45–60 minutes**.
- Follow the recommended per-question time:
  - Single Correct / Objective: **1–2 minutes**
  - Numerical Value: **2–3 minutes**
  - Integer Type: **3–4 minutes**
  - Advanced Multi-Correct: **4–6 minutes**
  - Paragraph (Advanced): **6–8 minutes**
- Mark questions exceeding time limit with a star (*) and revisit after finishing the DPP.

4. Best Practices for Scoring Higher

- Focus on accuracy first, then speed.
- Review every calculation step—most mistakes arise from small algebraic slips.
- Solve advanced problems only after finishing Main-level questions for the chapter.
- Revise solved DPPs weekly and note repeating mistake patterns.
- Use short notes for formulas, special results, and commonly used approximations.
- After solving, compare your approach with the official solution or teacher's method.
- Build endurance by solving at least one DPP in exam-like conditions daily.

5. Evaluation Guidelines

- Award yourself:
  - **+4 / -1** for JEE Main pattern questions.
  - **Partial marking** for JEE Advanced style multi-correct.
- Maintain a cumulative score record for every DPP set.
- Track:
  - Chapters with highest accuracy
  - Chapters needing revision
  - Time taken per DPP
  - Common error types

6. Weekly Review Checklist

- Reattempt the unsolved or incorrect problems from the past 5–7 DPPs.
- Update your formula sheet and mistake notebook.
- Solve at least one mixed-topic DPP to test retention.

By: www.udgamwelfarefoundation.com (helping students since 2012)

Set 2 - Limits and Continuity

Subjective Questions

1. Prove that $\lim_{x\to\infty} \frac{(3x-1)(2x+5)}{(x-3)(3x+7)} = 2$
2. Show that $f(x) = \frac{1}{1+e^{\frac{1}{x}}}$ when $x \neq 0, = 0$ when $x = 0$ is not continuous at $x = 0$
3. Discuss the continuity of the function $f(x)$ defined by $f(x) = \frac{e^{\frac{1}{x}}-1}{e^{\frac{1}{x}}+1}, x \neq 0$, $f(0) = -1$
4. Show that $\lim_{x\to-2} \frac{\tan \pi x}{x+2} + \lim_{x\to\infty}(1 + \frac{1}{x^2})^x > 3$
5. Evaluate $\lim_{x\to\frac{\pi}{3}} \frac{\tan^3 x - 3\tan x}{\cos(x+\frac{\pi}{6})}$

Multiple Choice Questions

6. If $f(2) = 4$ and $f'(2) = 1$ then $\lim_{x\to2} \frac{xf(2)-2f(x)}{x-2}$ equals:
   (a) 0
   (b) 2
   (c) 4
   (d) 6
7. Find the value of k if $\lim_{x\to0} \frac{\log(a+x)-\log a}{x} + k \lim_{x\to e} \frac{\log x - 1}{x-e} = 1$:
   (a) $e[1 - \frac{1}{a}]$
   (b) $e[1 + \frac{1}{a}]$
   (c) $e[\frac{1}{a} - 1]$
   (d) $e[2 - \frac{1}{a}]$
8. Let $f : R \to R$ be a differentiable function having $f(2) = 6$, $f'(2) = \frac{1}{48}$. The value of $\lim_{x\to2} \frac{\int_6^{f(x)} 4t^3 dt}{x-2}$ is:
   (a) 12
   (b) 18
   (c) 24
   (d) 36
9. Given $f'(2) = 6$ and $f'(1) = 4$ then $\lim_{h\to0} \frac{f(2h+2+h^2)-f(2)}{f(h-h^2+1)-f(1)}$:
   (a) does not exist
   (b) is equal to $\frac{-3}{2}$
   (c) equal to 3
   (d) equal to 2

10. If $f(x) = \cot^{-1}(\frac{3x-x^3}{1-3x^2})$ and $g(x) = \cos^{-1}(\frac{1-x^2}{1+x^2})$ then $\lim_{x\to 0} \frac{f(x)-f(a)}{g(x)-g(a)}, 0 < a < \frac{1}{2}$ is:
    (a) $\frac{-3}{2x}$
    (b) $\frac{-3(1+x)}{2}$
    (c) $\frac{-3}{2}$
    (d) $\frac{-3(1-a^2)}{2}$

11. f is defined in $[-5, 5]$ as $f(x) = x$ if x is rational, $= -x$ if x is irrational. Then:
    (a) $f(x)$ is continuous at every x, except $x = 0$
    (b) $f(x)$ is discontinuous at every x, except $x = 0$
    (c) $f(x)$ is continuous everywhere
    (d) $f(x)$ is discontinuous everywhere

12. $f(x)$ and $g(x)$ are two differentiable functions on $[0, 2]$ such that $f''(x) - g''(x) = 0$, $f'(1) = 2g'(1) = 4$, $f(2) = 3g(2) = 9$ then $f(x)-g(x)$ at $x = \frac{3}{2}$:
    (a) 0
    (b) 4
    (c) 5
    (d) 3

13. Let $f(a) = g(a) = k$ and their nth derivatives $f^n(a)$, $g^n(a)$ exist and are not equal for some n. Further if $\lim_{x\to a} \frac{f(a)g(x)-f(a)-g(a)f(x)+f(a)}{g(x)-f(x)} = 4$ then the value of k is:
    (a) 4
    (b) 1
    (c) 2
    (d) -1

14. $\lim_{x\to \frac{\pi}{2}} \frac{[1-\tan(\frac{x}{2})][1-\sin x]}{[1+\tan(\frac{x}{2})][\pi-2x]^3}$ is:
    (a) $\frac{1}{32}$
    (b) $\frac{1}{8}$
    (c) $\frac{1}{16}$
    (d) 0

15. If
$$f(x) = \begin{cases} xe^{-(\frac{1}{|x|}-\frac{1}{x})}, & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$$
then $f(x)$ is:
    (a) continuous for all x but not differentiable at $x = 0$
    (b) discontinuous everywhere
    (c) neither differentiable nor continuous at $x = 0$
    (d) continuous everywhere