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\documentclass[10pt]{article}
\usepackage{fancyhdr}
\usepackage{graphicx}
\usepackage{enumerate}
\usepackage{smartdiagram}
\usepackage{tabularx}
\usepackage{tikz}
\usepackage{pgfplots}
\usepackage{enumitem}
\usepackage{multicol}
\usepackage{amssymb}
\usepackage{amsmath}

```

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\begin{document}
\pagestyle{fancy}
\fancyhead{} % clear all header fields
\fancyhead[LO,LE]{JEE (Advanced) 2023 \ \ Purvi Porwal}
\fancyhead[RO,LE]{\textbf{Paper 1 \ \ 0801CS221114}}
\fancyfoot{} % clear all footer fields
\fancyfoot[LE,RO]{\thepage}

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Q.1 Let $S = \{0, 1\}$ and $T = \{0, 1, 2, 3\}$. Then which of the following statements is(are) true?

- (A) There are infinitely many functions from S to T
- (B) There are infinitely many strictly increasing functions from S to T
- (C) The number of continuous functions from S to T is at most 120
- (D) Every continuous function from S to T is differentiable

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{Q.2} The following graph represents the function $f(x)$:

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\begin{center}
\begin{tikzpicture}
\begin{axis}
xlabel={x},
ylabel={f(x)},
xmin=-2, xmax=2,
ymin=-2, ymax=2,
xtick={-2,-1,0,1,2},

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ytick={-2,-1,0,1,2},
grid=both,
major grid style={line width=.2pt,draw=gray!50},
width=0.7\textwidth,
height=0.5\textwidth
]
\addplot[blue, domain=-2:2, samples=100]{x^3 - x};
\end{axis}
\end{tikzpicture}
\end{center}

```

Which of the following statements about $f(x)$ is correct?

- Item A. The function $f(x)$ is even.
- Item B. The function $f(x)$ is odd.
- Item C. The function $f(x)$ has a local maximum at $(x = 0)$.
- Item D. The function $f(x)$ is periodic.

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Q.3 Let P be a point on the parabola $y^2 = 4ax$, where $a > 0$. The normal to the parabola at P meets the x -axis at a point Q . The area of the triangle PFQ , where F is the focus of the parabola, is 120. If the slope m of the normal and a are both positive integers, then the pair (a, m) is

- (A) (2,3)
- (B) (1,3)
- (C) (2,4)
- (D) (3,4)

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Q.4 Let $A = \frac{1967 + 1687i \sin \theta}{7 - 3i \cos \theta}$, $\theta \in \mathbb{R}$. If A contains exactly one positive integer n , then the value of n is

\bigskip

{Q.5} Let a and b be two nonzero real numbers. If the coefficient of $(5x)$ in the expansion of

\[

$$\frac{4}{27}ax + \frac{70}{27}bx$$

]

is equal to the coefficient of $(5x^{-1})$ in the expansion of

[

$$\frac{1}{2}(ax + bx)^{-1}$$

]

then the value of $(2b)$ is

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{Q.6} Match the items in List-I with the items in List-II and choose the correct option from the given choices.

\item \textbf{1.}{List-I:}

\item A. Newton's First Law of Motion

\item B. Ohm's Law

\item C. Boyle's Law

\item D. Avogadro's Law

\item \textbf{List-II:}

\item P. Relates the pressure and volume of a gas at constant temperature

\item Q. Relates the current passing through a conductor to the voltage and resistance

\item R. States that an object at rest tends to stay at rest, and an object in motion tends to stay in motion

\item S. Relates the volume and number of moles of a gas at constant pressure and temperature

Choose the correct option:

\item A. (1-P), (2-Q), (3-R), (4-S)

\item B. (1-R), (2-P), (3-Q), (4-S)

\item C. (1-S), (2-Q), (3-R), (4-P)

\item D. (1-P), (2-Q), (3-S), (4-R)

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{Q.7}Consider the following table of data for the motion of a particle:

\begin{center}

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\begin{tabular}{|c|c|c|}
\hline
Time (s) & Velocity (m/s) & Acceleration (m/s\textsuperscript{2}) \\
\hline
0 & 5 & 2 \\
1 & 7 & 3 \\
2 & 10 & 2 \\
3 & 12 & 1 \\
\hline
\end{tabular}
\end{center}

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- \item A. Plot the velocity-time graph for the particle.
- \item B. Calculate the displacement of the particle from $(t = 0)$ to $(t = 3)$ seconds.
- \item C. Using the smart diagram below, illustrate the relationship between velocity, acceleration, and time.

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\begin{center}
\smartdiagram[flow diagram:horizontal]{
  Velocity,Acceleration,Time
}
\end{center}

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\section*{Section 1 (Maximum Marks: 12)}
\begin{multicols}{3} % Adjust the number of columns as needed
\begin{enumerate}[label=\textbf{Q.\arabic*}]
  \item This is the first question.
  \begin{enumerate}[label=\alph*]
    \item (A) Option 1
    \item (B) Option 2
    \item (C) Option 3
    \item (D) Option 4
  \end{enumerate}
\end{enumerate}

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\item This is the second question.
\begin{enumerate}[label=\alph*]
  \item (A) Option 1
  \item (B) Option 2
  \item (C) Option 3
  \item (D) Option 4
\end{enumerate}

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\end{enumerate}

\item This is the third question.

\begin{enumerate}[label=\alph*]

\item (A) Option 1

\item (B) Option 2

\item (C) Option 3

\item (D) Option 4

\end{enumerate}

\end{enumerate}

\end{multicols}

\begin{enumerate}

\item For each question, choose the option(s) corresponding to (all) the correct answer(s).

\item Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 ONLY if (all) the correct option(s) is(are) chosen;

Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;

Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;

Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -2 In all other cases.

\end{enumerate}

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{Q.8} The total number of sp^2 hybridized carbon atoms in the major product P (a non-heterocyclic compound) of the following reaction is .

\begin{enumerate}[label=(\Alph*)]

\item 2

\item 3

\item 4

\item 5

\end{enumerate}

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{Q9} Consider the following chemical reactions:

- \item $\mathrm{A} + \mathrm{B} \rightarrow \mathrm{C} + \mathrm{D}$
- \item $\mathrm{P} + \mathrm{Q} \rightarrow \mathrm{R} + \mathrm{S}$
- \item $\mathrm{X} + \mathrm{Y} \rightarrow \mathrm{Z} + \mathrm{W}$

For each reaction, choose the correct statement(s):

- \item Reaction (A) is an example of a redox reaction.
- \item Reaction (B) is an acid-base reaction.
- \item Reaction (C) is an example of a combustion reaction.
- \item In reaction (A), C and D are products.
- \item Reaction (P) is an endothermic reaction.
- \item In reaction (X), W is a solid product.

Choose the correct option(s):

- \item A. (1), (4), (5)
- \item B. (2), (3), (6)
- \item C. (1), (2), (6)
- \item D. (3), (4), (5)

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{Q.10} A gas has a compressibility factor of 0.5 and a molar volume of $0.4 \text{ dm}^3 \text{ mol}^{-1}$ at a temperature of 800 K and pressure x atm. If it shows ideal gas behavior at the same temperature and pressure, the molar volume will be y $\text{dm}^3 \text{ mol}^{-1}$. The value of (x/y) is $____$.

[Use: Gas constant, $(R = 8 \times 10^{-2}) \text{ L atm K}^{-1} \text{ mol}^{-1}$]

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\end{document}