

Dear student following is a Moderate level [0 0 ● 0 0] test paper. Score of 12 Marks in 10 Minutes would be a satisfactory performance. Questions 1-8 (+3, -1). (More than one options may be correct)

- Q.1** In a college of 300 students every student reads 5 newspapers and every newspaper is read by 60 students. The number of newspapers is-
- (A) At least 30 (B) At most 20
(C) Exactly 25 (D) None of these
- Q.2** If $A = \{1, 3, 5, 7, 9, 11, 13, 15, 17\}$,
 $B = \{1, 2, 4, \dots, 18\}$ and U is the universal set, then $A' \cup [(A \cup B) \cap B']$ is-
- (A) A (B) B
(C) U (D) None of these
- Q.3** Let $A = \{2, 4, 6, 8\}$ and define $R = \{(2, 4), (4, 2), (4, 6), (6, 4)\}$ then R is-
- (A) Anti symmetric (B) Reflexive
(C) Symmetric (D) Transitive
- Q.4** The domain of definition of the function
 $f(x) = x \frac{1+2(x+4)^{-0.5}}{2-(x+4)^{0.5}} + 5(x+4)^{0.5}$ is-
- (A) R (B) $(-4, 4)$
(C) R^+ (D) $(-4, 0) \cup (0, \infty)$
- Q.5** The period of the function
 $f(x) = [\sin 3x] + |\cos 6x|$ is-
- (A) π (B) $\frac{2\pi}{3}$
(C) 2π (D) $\frac{\pi}{2}$
- Q.6** The domain of $f(x) = \frac{\log_2(x+3)}{x^2+3x+2}$ is-
- (A) $R - \{-1, -2\}$
(B) $(-2, \infty)$
(C) $R - \{-1, -2, -3\}$
(D) $(-3, \infty) - \{-1, -2\}$
- Q.7** Let $f : (e, \infty) \rightarrow R$ be defined by
 $f(x) = \log [\log (\log x)]$ then-
- (A) f is one-one but not onto
(B) f is onto but not one-one
(C) f is both one one & onto
(D) The range of f is equal to its codomain
- Q.8** Let $f : R \rightarrow R$ be a function defined by
 $f(x) = \frac{x-m}{x-n}$, where $m \neq n$, then
- (A) f is one-one onto
(B) f is one-one into
(C) f is many one onto
(D) f is many one into

MATHEMATICS IIT JEE (07 / 06 / 2007) (SETS, RELATIONS & FUNCTIONS) ANSWER KEY

Name : Roll No. :

	A	B	C	D		A	B	C	D		A	B	C	D
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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ANSWER KEY

Que.	1	2	3	4	5	6	7	8
Ans.	C	C	C	D	B	D	C,D	B

SOLUTIONS

Sol.1 (C)

Let x be the number of newspapers

If each student reads one newspaper, then number of students $60x$. But each student reads 5 newspapers

$$\Rightarrow \text{number of students} = \frac{60x}{5}$$

$$\text{Given number of students} = 300 = \frac{60x}{5}$$

$$\Rightarrow x = 25$$

\Rightarrow Exactly 25 number of newspapers.

Sol.2 (C)

$$\therefore (A \cup B) \cap B' = U \cap B' = A$$

$$\therefore A' \cup [(A \cup B) \cap B'] = A' \cup A = U$$

Sol.3 (C)

$$R = \{(2, 4), (4, 2), (4, 6), (6, 4)\}$$

Clearly R is symmetric as $(2, 4) \in R$

$$\Rightarrow (4, 2) \in R$$

and $(4, 6) \in R$

$$\Rightarrow (6, 4) \in R$$

Sol.4 (D)

We have,

$$f(x) = x \frac{1 + \frac{2}{\sqrt{x+4}}}{2 - \sqrt{x+4}} + 5\sqrt{x+4}.$$

Clearly $f(x)$ is defined for $x + 4 > 0$ and $x \neq 0$.

$$\therefore D_f \equiv (-4, 0) \cup (0, \infty).$$

Sol.5 (B)

$$\text{Let } f_1(x) = [\sin 3x]$$

If $f_1(x)$ is periodic, then

$$f_1(x - h) = f_1(x) \quad [h \text{ is period}]$$

$$[\sin (3x + 3h)] = [\sin 3x]$$

$$\therefore 3h = 2\pi, 4\pi, 6\pi, \dots$$

$$\therefore h = \frac{2\pi}{3}, \frac{4\pi}{3}, 2\pi, \dots$$

$$\therefore \text{Period of } f_1(x) = \frac{2\pi}{3} \text{ (least +ve)}$$

$$\text{Let } f_2(x) = |\cos 6x| = \sqrt{\left(\frac{1 + \cos 12x}{2}\right)}$$

$$\therefore \text{period of } f_2(x) = \frac{2\pi}{12}$$

Hence period of $f(x)$

$$= \text{LCM of } \left(\frac{2\pi}{3}, \frac{2\pi}{12}\right) = \frac{2\pi}{3}$$

Sol.6 (D)

For domain of

$$f(x), x + 3 > 0 \text{ and } x^2 + 3x + 2 \neq 0$$

i.e. $x > -3$ and $x \neq -1, -2$.

Hence domain = $(-3, \infty) - \{-1, -2\}$.

Sol.7 (C, D)

$$\therefore \text{For } x \in (e, \infty), \log x > 1$$

$$\Rightarrow \log (\log x) > 0$$

$$\Rightarrow \log [\log (\log x)] \in (-\infty, \infty)$$

$$\text{for } x \in (e, \infty)$$

$\Rightarrow f$ is one one & onto.

And also range of f is equal to its codomain.

Sol.8 (B)

For one-one $f(x) = f(y)$

$$\Rightarrow \frac{x-m}{x-n} = \frac{y-m}{y-n}$$

$$\Rightarrow x = y$$

$\Rightarrow f$ is one-one

for onto let $f(x) = \alpha, \alpha \in \mathbb{R}$

$$\text{then } \frac{x-m}{x-n} = \alpha$$

$$\Rightarrow x = \frac{m - n\alpha}{1 - \alpha}$$

\Rightarrow for $\alpha = 1, x \notin \mathbb{R}$

$\Rightarrow f$ is not onto