ROYAL TUITION CENTER, ELAMPILLAI CELL: 9080244280

CLASS   : X

SUBJECT   : MATHS

MARKS   : 75

TIME   : 150 Min

I. ANSWER ALL THE QUESTIONS   1x10 = 10

1. $f(x) = (x+1)^3 - (x-1)^3$ represents a function which is

   (1) linear   (2) cubic   (3) reciprocal   (4) quadratic

2. If $g = \{(1,1),(2,3),(3,5),(4,7)\}$ is a function given by $g(x) = \alpha x + \beta$ then the values of α and β are

   (1) $(-1,2)$ (2)$(2,-1)$ (3) $(-1,-2)$ (4) $(1,2)$

3. If $f : A \to B$ is a bijective function and if $n(B) = 7$, then $n(A)$ is equal to

   (1) 7   (2) 49   (3) 1   (4) 14

4. If $f(x) = 2x^2$ and $g(x) = \dfrac{1}{3x}$, then $f \circ g$ is

   (1) $\dfrac{3}{2x^2}$ (2) $\dfrac{2}{3x^2}$ (3) $\dfrac{2}{9x^2}$ (4) $\dfrac{1}{6x^2}$

5. If $\{(a,8),(6,b)\}$ represents an identity function, then the value of a and b are respectively

   (1) (8,6)   (2) (8,8)   (3) (6,8)   (4) (6,6)

6. Let $n(A) = m$ and $n(B) = n$ then the total number of non-empty relations that can be defined from A to B is

   (1) m^n (2) n^m (3) $2^{mn} - 1$ (4) 2^{mn}

7. If $n(A \times B) = 6$ and $A = \{1,3\}$ then $n(B)$ is

   (1) 1   (2) 2   (3) 3   (4) 6

8. $A = \{a,b,p\}, \ B = \{2,3\}, \ C = \{p,q,r,s\}$ then $n[(A \cup C) \times B]$ is

   (1) 8   (2) 20   (3) 12   (4) 16

9. If there are 1024 relations from a set $A = \{1, 2, 3, 4, 5\}$ to a set B, then the number of elements in B is

   (1) 3   (2) 2   (3) 4   (4) 8

10. The range of the relation $R = \{(x,x^2) \mid x$ is a prime number less than 13$\}$ is

    (1) $\{2,3,5,7\}$ (2) $\{2,3,5,7,11\}$

    (3) $\{4,9,25,49,121\}$ (4) $\{1,4,9,25,49,121\}$

II. ANSWER ANY 10 QUESTIONS. 20 AND 21 IT'S A COMPULSORY QUESTIONS   10x2=20

11. If $A \times B = \{(3,2), (3,4), (5,2), (5,4)\}$ then find A and B.

12. Let $A = \{1,2,3\}$ and $B = \{x \mid x$ is a prime number less than 10$\}$. Find $A \times B$ and $B \times A$.

13. The arrow diagram shows (Fig.1.10) a relationship between the sets P and Q. Write the relation in (i) Set builder form (ii) Roster form (iii) What is the domain and range of R.
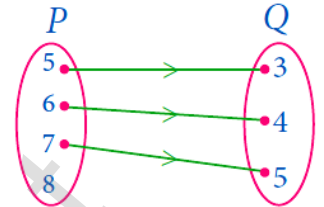
Fig. 1.10

14. Given $f(x) = 2x - x^2$,

   find (i)$f(1)$ (ii) $f(x+1)$

15. A function f is defined by $f(x) = 3 - 2x$. Find x such that $f(x^2) = (f(x))^2$.

16. Show that the function $f : \mathbb{N} \to \mathbb{N}$ defined by $f(m) = m^2 + m + 3$ is one-one function.

17. Find $f \circ g$ when $f(x) = 2x + 1$ and $g(x) = x^2 - 2$

18. Find k if $f \circ f(k) = 5$ where $f(k) = 2k - 1$.

19. (i) If $f(x) = x^2 - 1$, $g(x) = x - 2$ find a, if $g \circ f(a) = 1$.

20. Find the domain of the function $f(x) = \sqrt{1 + \sqrt{1 - \sqrt{1 - x^2}}}$

21. Given that $f(x) = \begin{cases} \sqrt{x - 1} & x \geq 1 \\ 4 & x < 1 \end{cases}$. Find (i) $f(0)$ (ii) $f(3)$

22. Define One to one and Onto

III. ANSWER ANY 9 QUESTIONS .25 AND 31 IT'S A COMPULSORY QUESTIONS   9x5=45

23. Consider the functions $f(x)$, $g(x)$, $h(x)$ as given below. Show that $(f \circ g) \circ h = f \circ (g \circ h)$ in each case.

   (i) $f(x) = x - 1$, $g(x) = 3x + 1$ and $h(x) = x^2$

   (ii) $f(x) = x^2$, $g(x) = 2x$ and $h(x) = x + 4$

24. Find x if $gff(x) = fgg(x)$, given $f(x) = 3x + 1$ and $g(x) = x + 3$.

25. The function 't' which maps temperature in Celsius (C) into temperature in Fahrenheit (F) is defined by $t(C) = F$ where $F = \dfrac{9}{5}C + 32$. Find,

   (i) $t(0)$ (ii) $t(28)$ (iii) $t(-10)$

   (iv) the value of C when $t(C) = 212$

   (v) the temperature when the Celsius value is equal to the Farenheit value.

26. If the function $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = \begin{cases} 2x + 7, x < -2 \\ x^2 - 2, -2 \le x < 3 \\ 3x - 2, x \ge 3 \end{cases}$,

then find the values of

(i) $f(4)$ (ii) $f(-2)$ (iii) $f(4) + 2f(1)$ (iv) $\dfrac{f(1) - 3f(4)}{f(-3)}$

27. Let f be a function $f : \mathbb{N} \to \mathbb{N}$ be defined by $f(x) = 3x + 2, x \in \mathbb{N}$

(i) Find the images of 1, 2, 3   (ii) Find the pre-images of 29, 53

(ii) Identify the type of function

28. Let $A = \{1,2,3,4\}$ and $B = \{2,5,8,11,14\}$ be two sets. Let $f : A \to B$ be a function given by $f(x) = 3x - 1$. Represent this function

(i) by arrow diagram   (ii) in a table form

(iii) as a set of ordered pairs   (iv) in a graphical form

29. Given the function $f : x \to x^2 - 5x + 6$, evaluate

(i) $f(-1)$ (ii) $f(2a)$

(iii) $f(2)$ (iv) $f(x - 1)$

30. Let $A = \{x \in \mathbb{W} \mid x < 2\}$, $B = \{x \in \mathbb{N} \mid 1 < x \le 4\}$ and $C = \{3,5\}$. Verify that

(i) $A \times (B \cup C) = (A \times B) \cup (A \times C)$ (ii) $A \times (B \cap C) = (A \times B) \cap (A \times C)$

31. The functions f and g are defined by $f(x) = 6x + 8$; $g(x) = \dfrac{x-2}{3}$

(i) Calculate the value of $gg\left(\dfrac{1}{2}\right)$

(ii) Write an expression for $gf(x)$ in its simplest form.

32. An open box is to be made from a square piece of material, 24 cm on a side, by cutting equal squares from the corners and turning up the sides as shown (Fig.1.17). Express the volume V of the box as a function of x.
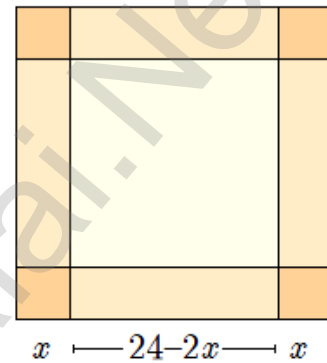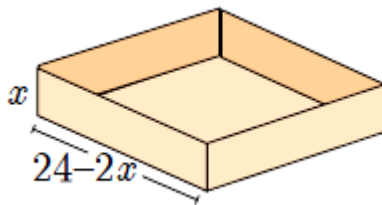
33.   Forensic scientists can determine the height (in cms) of a person based on the length of their thigh bone. They usually do so using the function $h(b) = 2 \cdot 47b + 54 \cdot 10$ where b is the length of the thigh bone.

(i) Check if the function h is one – one

(ii) Also find the height of a person if the length of his thigh bone is 50 cms.

(iii) Find the length of the thigh bone if the height of a person is $147 \cdot 96$ cms.