1. let $f : R_+ \to [-5, \infty)$ be defined as $f(x) = 9x^2 + 6x - 5$ where R_+ is the set of all non-negative real numbers, then f is:
   (a) one-one
   (b) onto
   (c) bijective
   (d) neither one-one nor onto

2. The number of points of discontinuity of $f(x) = \begin{cases} |x| + 3, & if x \leq -3 \\ -2x, & if -3 < x < 3 \\ 6x + 2, & if x \geq 3 \end{cases}$ is:
   (a) 0
   (b) 1
   (c) 2
   (d) infinite

3. The function $f(x) = x^3 - 3x^2 + 12x - 18$ is:
   (a) strictly decreasing on R
   (b) strictly increasing on R
   (c) neither strictly increasing nor strictly decreasing on R
   (d) strictly decreasing on $(-\infty, 0)$

4. Find the domain of the function $f(x) = \sin^{-1}(x^2 - 4$. Also, find its range.

5. If $f(x) = |\tan 2x|$, then find the value of $f'(x)$ at $x = \frac{\pi}{3}$.

6. If M and m denote the local maximum and local minimum values of the function $f(x) = x + \frac{1}{x}(x \neq 0)$ respectively, find the value of $(M - m)$.

7. Show that $f(x) = e^x - e^{-x} + x - \tan^{-1} x$ is strictly increasing in its domain.

8. Show that a function $f : R \to R$ defined bt $f(x) = \frac{2x}{1+x^2}$ is neither one-one nor onto. Further, find set A so that the given function $f : R \to A$ becomes an onto function.

9. A relation R is defined on $N \times N$ (where N is the set f natural numbers) as:
   $$(a, b)R(c, d) \leftrightarrow a - c = b - d$$
   Show that R is an equivalence relation.

10. The month of September is celebrtaed as the Rashtriya Poshan Maah across the country. Following a healthy and well-balanced diet is crucial in order to supply the body with the proper nutrients it needs. A balanced diet also keeps us mentally fit and promotes improved level of energy.
    A dietician wishes to minimize the cost of a diet involving two types

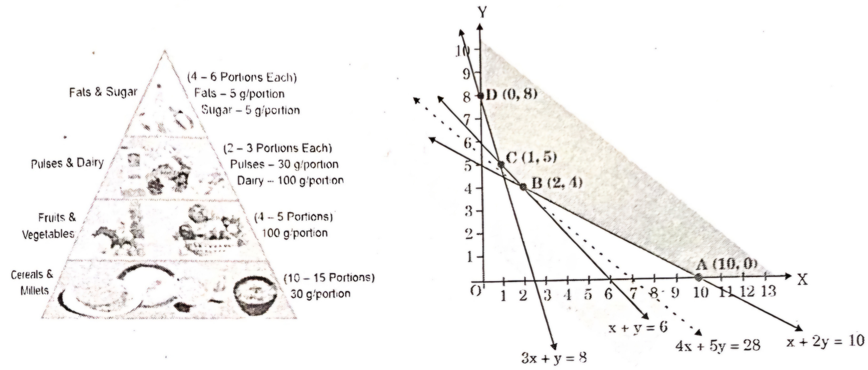

Figure 1: 1

of foods,food $X(xkg)$ and fodd $Y(ykg)$ which are available at the rate of $|16/kg$ and $|20/kg$ respectively. The feasible region satisfying the constraints is shown in the graph.

On the basis of the above information, answer the following questions:

(i) Identify and write all the constraints which determine the given feasible region in the above graph.

(ii) If the objective is to minimize cost $Z = 16x+20y$, find the values of x and y at which cost is minimum. Also, find minimum cost assuming that minimum cost is possiblr for the given unbounded region.