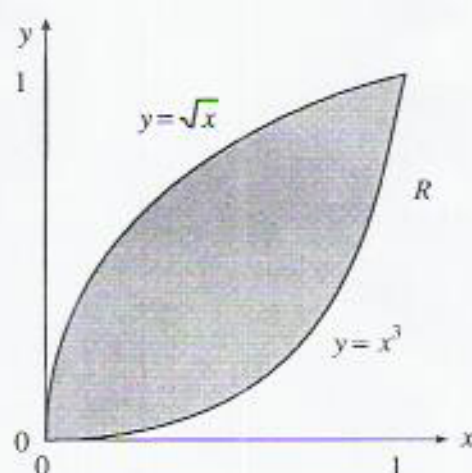


2. The region  $R$  over which the double integral

$$I = \iint_R (x+y) dx dy$$

is integrated is shown in the figure.



- (a) Write  $I$  as a repeated integral, integrating with respect to  $y$  first, and calculate its value. [5]
- (b) Write  $I$  as a repeated integral in which the integration with respect to  $x$  is carried out first. (You are not required to calculate the value of this repeated integral.) [3]
3. The level surfaces of the function  $w = f(x, y, z) = 3x^2 + 2y^2 + z^2 - 6$  are the ellipsoids  $w = \text{constant}$ .
- (a) Find the level surface which passes through  $(1, 1, 1)$ . [1]
- (b) Find the vector  $\text{grad } f$  and use it to find a vector normal to the level surface at  $(1, 1, 1)$ . [2]
- (c) Find the equation of the tangent plane to the level surface at  $(1, 1, 1)$ . [2]
- (d) Find the equation of the plane which passes through  $(1, 1, 1)$  and which contains the normal to the level surface at  $(1, 1, 1)$  and the radius vector joining the origin to  $(1, 1, 1)$ . [4]