Q1:- A wire of length 12 in can be bent into a circle, a square, or cut to make both a circle & a square. Determine a ftn that expresses the combined area of both figures interms of one variable.

Sol

$A_c = \pi r^2$

$A_s = s^2$

$A_T = \pi r^2 + s^2$

$C = 2\pi r$

$P = 4s$

$12 = 2\pi r + 4s$

$s = \frac{12 - 2\pi r}{4}$

$s = 3 - \frac{1}{2}\pi r$

$A_T = \pi r^2 + \left(3 - \frac{1}{2}\pi r\right)^2$

Q2:- A Company manufactures cylindrical barrels to store nuclear waste. The top & bottom of the barrels are to be made with material that costs \$10 per sq ft & the rest is made with material that costs \$8 per sq ft. If each barrel is to hold 5 cubic feet. express the cost ftn interms of one variable.

Sol

$C = 10 \times 2\pi r^2 + 8 \times 2\pi r h$

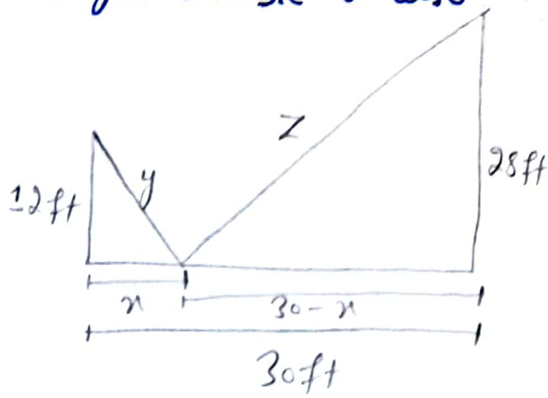
$5 = \pi r^2 h$

$h = \frac{5}{\pi r^2}$

$C(r) = 20\pi r^2 + \frac{80\pi r}{\pi r^2}$

$C(r) = 20\pi r^2 + \frac{80}{r}$ $\quad (0, \infty)$

Q3:- Two posts, one 12 ft high & other 28 ft high, stand 30 ft apart. They are to be stayed by two wires, attached to a single stake, running from ground level to the top of each post. Write length of the wire as a fn of single variable & also find the domain.



Sol $W = y + z$

By pythagorean theorem

$$(x)^2 + (12)^2 = y^2$$

$$(30-x)^2 + (28)^2 = z^2$$

$$y = \sqrt{x+144}$$

$$z = \sqrt{x^2 - 60x + 1684}$$

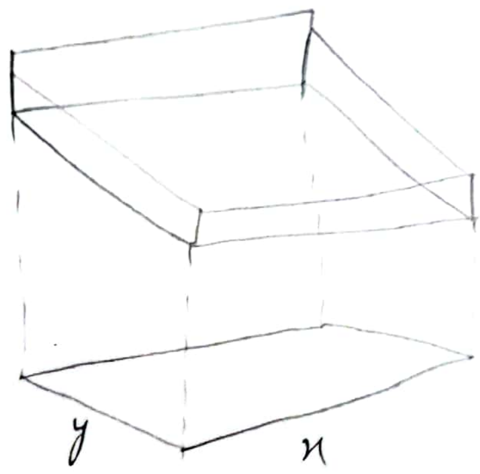
$$W = \sqrt{x^2+144} + \sqrt{x^2 - 60x + 1684}$$

$0 \le x \le 30$

Q4:- A homeowner has \$320 to spend on building a fence around a rectangular garden. Three sides of the fence will be constructed with wire fencing at a cost of \$2 per linear foot. The fourth side will be constructed with wood fencing at a cost of \$6 per linear foot. Find out the formula for area of the garden & also find the domain.

Sol $A = xy$

Cost of fencing



$$C = 2y + 2x + 2y + 6x$$

$$C = 8x + 4y$$

$$320 = 8x + 4y$$

$$4y = 320 - 8x$$

$$y = 80 - 2x$$

$A = x(80-2x) \Rightarrow 80x - 2x^2$ Domain $0 \le x \le 40$ $[0, 40]$

Q5:- A paint manufacturer wants cylindrical cans for its speciality enamels. The can is to have a Vol of 15 fluid ounces, which is approximately 27 in^3. Inorder to manufacture a can that will require least amount of material write a formula for surface area interms of single variable & also find domain.

Sol

S = Total surface area = top + bottom + lateral area

$$S = 2\pi r^2 + 2\pi r h$$

$$V = \pi r^2 h$$

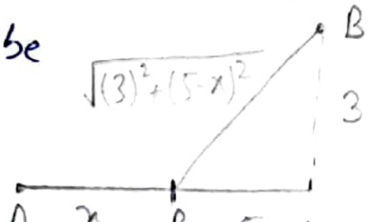
$$27 = \pi r^2 h$$

$$h = \frac{27}{\pi r^2}$$

$$S(r) = 2\pi r^2 + 2\pi r \cdot \frac{27}{\pi r^2} \qquad D: (0, \infty)$$

Q6:- The highway department is asked to construct a road b/w pt A & point B. Point A lies on an abandoned road that runs east-west. Point B is 3 miles north of the point of the old road that is 5 miles east of A. The engineering division proposes that the road be constructed by restoring a section of old road from A to some point P & constructing a new road from P to B. Given that the cost of restoring the old road is \$2,000,000 per mile & the cost of a new road is \$4,000,000 per mile. Write the fn for cost of construction of the road & also find the domain.

Sol Let 'x' be the amount of old road that will be restored.



$$d = \sqrt{9 + (5-x)^2}$$

$$d = \sqrt{34 - 10x + x^2}$$

Total cost of constructing the two sections of road is

$$C(x) = 2 \cdot 10^6 x + 4 \cdot 10^6 [34 - 10x + x^2]^{1/2} \qquad 0 \le x \le 5$$