Course Code : CS-60
Course Title : FOUNDATION COURSE IN MATHEMATICS IN COMPUTING
Assignment Number : BCA(2)-60/Assignment/2011
There are five questions in this assignment. Answer all the questions.

Question 1: (i) Find the complex conjugate of (3+5i)/(1+2i)
Ans:

$$z = \frac{3+5i}{1+2i} * \frac{1-2i}{1-2i}$$

$$z = \frac{(3+5i)(1-2i)}{i-(2i)^2} = \frac{3-6i+5i-10i^2}{1-4i^2} = \frac{3-i-10}{1+4} = \frac{13-i}{5} = \frac{1}{5}(13-i)$$

$$\overline{z} = \frac{1}{5}(13-i)$$

(ii) Differentiate (sin x)x w.r.t. x.
Ans:

$$y = x\sin x$$

$$\frac{dy}{dx} = \sin x * 1 + x\cos x$$

$$\frac{dy}{dx} = \sin x + x\cos x$$

(iii) Find all the seventh roots of (3+4i).
Ans:

Let

r =

where

$r+\cos\theta + i\sin\theta = \sqrt[7]{3+4i}$

$\cos\theta + i\sin\theta = 3+4i$

$(\cos\theta + i\sin\theta)^7 = 3+4i$

$\cos 7\theta + i\sin 7\theta = 3+4i$

$\cos 7\theta = 3$

$7\theta = \cos^{-1}(n\pi+3)$

$\theta = 1/2\cos^{-1}(n\pi+3)$

Question 2: (i) Find the equation of the line joining the points (?, 6, ? 3) and (7, ? 6, 3).

Ans:

equation of a line is :

$$= \frac{y-y1}{y2-y1} = \frac{x-x1}{x2-x1} = \frac{z-z1}{z2-z1}$$

$$\frac{x+1}{7+1} = \frac{y-6}{-6-6} = \frac{z-3}{3+3}$$

$$\frac{x+1}{8} = \frac{y-6}{-12} = \frac{z-3}{6}$$

(ii) Find the equation of the sphere, which contains the circle x2 + y2 + z2 = 18 , 3x + 3y + 3z = 11 and passes through the origin.

Ans:

Equation of a sphere is :

$(x^2 + y^2 + z^2 - 18) + \lambda(3x + 3y + 3z - 11) = 0$ --------- 1

since it passes through the origin So,
(0,0,0) satisfies the above equation

$0 + 0 + 0 - 18 + \lambda(0 + 0 + 0 - 11) = 0$

$-11\lambda = 18$

$\lambda = \frac{-18}{11}$

Putting the value of λ in eq 1

$(x^2 + y^2 + z^2 - 18) \frac{-18}{11}(3x + 3y + 3z - 11) = 0$

solving the above equation we get

$11x^2 + 11y^2 + 11z - 54x - 54y - 54z = 0$ this is the eq of sphere

Question 3: (i) Find lim 1+x2/x2
x → ∞
Ans:

$\lim_{x \to \infty} \frac{1+x^2}{x^2}$ $\quad \because \int \frac{f'(x)}{f(x)} = \log x \;\; 2$

$\lim_{x \to \infty} \frac{1}{x} + \lim_{x \to \infty} 1$

$= \frac{1}{\infty^2} + 1 = \frac{1}{0} + 1 = 1$

(ii) Compute the area bounded by y2 = 9x and x2 = 9y

Hint: For finding the points of intersection of the given curve, we solve the given equation simultaneity.

$x^2 = 9y = x^2/9$ substituting $y = x^2/9$ in $y^2 = 9x$

$(x^2/9)^2 = 9x$

$(x^2/81) = 9x$

$(x^4/81) - 9x = 0$

$x(x^3 - 729) = 0$

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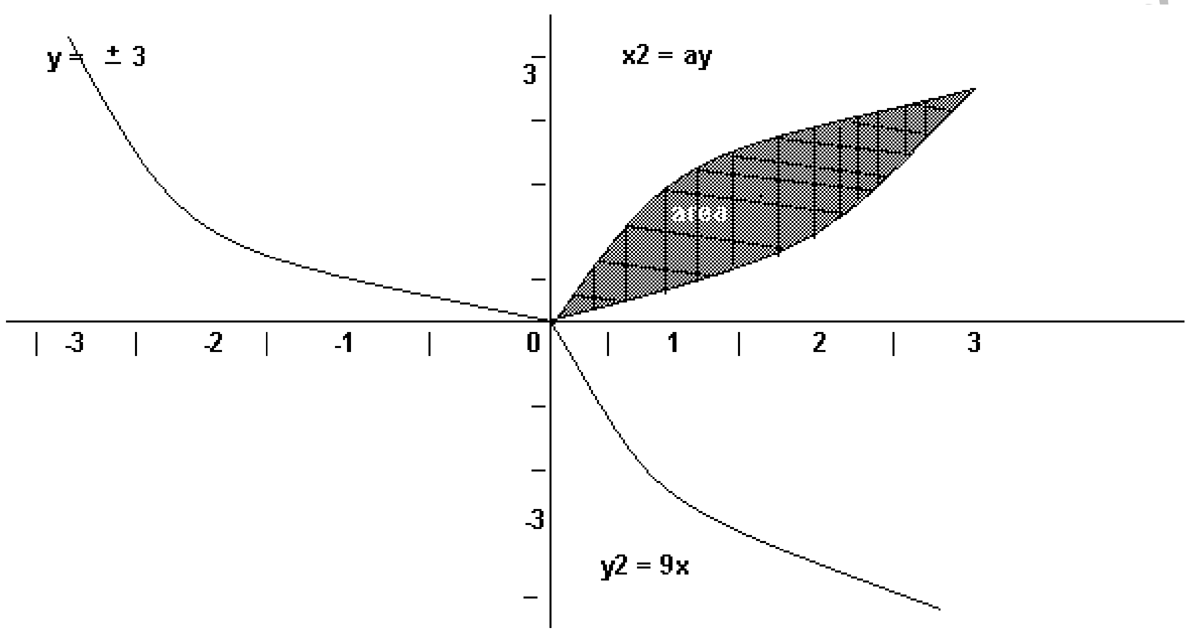
x =0 or x = 9
y =0 or y = 9
hence point of intersection are (0,0) (9,9) Required area = (area OBAD) – (area OCAD)

$$\int_0^a y\,dx\,[for\ y^2 = 9x] - \int_0^a y\,dx\,[for\ x^2 = 9y]$$



$$\int_0^a 3\sqrt{x}\,dx - \int_0^a \frac{x^2}{a}\,dx$$

$$3\left[\frac{x^{3/2}}{\left(\frac{3}{2}\right)}\right]_0^9 - \left[\frac{x^3}{9 \times 3}\right]_0^9$$

$$2\left[x^{3/2}\right]_0^9 - \frac{1}{27}\left[x^3\right]_0^9$$

$$2\left(9^{3/2}\right) - 2(0) - \frac{1}{27}\left[9^3 - 0\right]$$

= 54 – 27
=27 Ans

(iii) Evaluate: . $\tan^{-1} xdx$
Ans:

$$I = \int \tan^{-1} x\,dx = \int \tan^{-1} x.\,1\,dx$$

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$$= \tan^{-1} x \cdot x - \int \left(\frac{1}{1+x^2}\right) x\,dx$$
$$= x\tan^{-1} x - \frac{1}{2}\log|1+x^2| + c$$

Question 4: Use the Cauchy - Schwarz inequality to solve $x^3 - 25x^2 - 4x + 100 = 0$, given that all its roots are rational.
Ans:

The Cauchy-Schwarz inequality says that for positive numbers a_i and b_i, $1 \leq i \leq n$,

$$\sum_{i=1}^{n} a_i^2 \cdot \sum_{i=1}^{n} b_i^2 \geq \left(\sum_{i=1}^{n} a_i \cdot b_i\right)^2$$

The best way is to factor $x - 25$ out, leaving

$$(x-25)\cdot\left(x^2-4\right) = 0$$

From here, it is apparent that x = 25, -2, or 2.

Question 5: (i) Find the perimeter of the cord r = a (1 + cos)
Ans: To find the perimeter of the cord r = a(1 + cos) we note that the curve is symmetrical about the initial line (Fig)

Now, dv/d□= - a sin . Hence we have

$$= 2\int_0^{\pi} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\, d\theta$$
$$= 2a\int_0^{\pi} \sqrt{(1+\cos\theta)^2 + \sin^2\theta}\, d\theta$$
$$= 2a\int_0^{\pi} \sqrt{2(1+\cos\theta)^2}\, d\theta$$
$$= 4a\int_0^{\pi} \cos\frac{\theta}{2}\, d\theta$$
$$4a\left|2\sin\frac{\theta}{2}\right|_0^{\pi}$$
= 8a

(ii) Find all the seventh roots of (3+4i).
Ans: Same as Q1(iii)