MATH 381 L01 F 2010

MAPLE ASSIGNMENT

1. (a) Evaluate π to 10 digits [Ans. = 3.141592654]

   (b) Evaluate π to 100 digits.

   (c) What is the 100th digit of π? Explain your answer.

2. Evaluate

$$\int_0^{\pi/2} (7\sin^4 x + 5\cos^6 x)^2 dx \qquad [20335\pi/2048]$$

3. (a) Plot $y = x^3 - 2x^2 - x - 1, \quad -3 \leq x \leq 3.$

   (b) Using (a), estimate the zeros (roots) of this cubic polynomial.

   (c) Use the fsolve command to obtain accurate estimations of the zeros.

4. Consider the 4×4 symmetric matrix $C = \begin{bmatrix} 4 & 3 & 1 & 6 \\ 3 & 22 & 0 & 3 \\ 1 & 0 & 3 & -2 \\ 6 & 3 & -2 & 21 \end{bmatrix}$

   (a) Find $\det(C)$. [1556]

   (b) Find the eigenvalues of C.

   (c) Is C positive definite, negative definite, or indefinite. Explain.

5. (a) Make a 3-dimensional plot of $z = f(x, y) = y^2 - x^2$, $-1 \leq x \leq 1, -2 \leq y \leq 2$.

   (b) Make a contour plot of the same function, $-2 \leq x \leq 2$, $-2 \leq y \leq 2$.

   (c) By inspection of (a) or (b), describe the type of critical point f has at $(0, 0)$.

6. Evaluate

$$\int_1^2 \int_0^x \int_0^{3y-x} (x^3y^4 + e^z)\ dzdydx \qquad [-\frac{1}{3e} + \frac{2919}{100} - \frac{e^2}{6} + \frac{1}{3e^2} + \frac{e^4}{6}]$$

7. Find and classify the extrema of $f(x, y) = (x^2 + 3y^2)e^{1-x^2-y^2}$.

8. Evaluate the line integral $\int_{\mathcal{C}} \langle y,\, x,\, z^2 \rangle \bullet \mathrm{d}\mathbf{r}$, where $\mathcal{C}$ is the path $\mathbf{r}(t) = \langle t^2 + t,\, 2t,\, t^4 + t^3 \rangle$, $1 \le t \le 3$. [1259908/3]

9. Evaluate the surface integral of $x^2 + y + z$ over the surface $\mathcal{S}$ given by $\mathbf{r}(s,t) = \langle s,\ t,\ s + t \rangle$, $0 \le s \le 1,\ 0 \le t \le 1$.

10. Consider the vector field $\mathbf{F}(x,y,z) = \langle 3xy^2 + z^3,\ xyz^9 - y^2,\ 3x^4 + yz^7 \rangle$.

    (a) Find $\mathrm{Curl}(\mathbf{F}) = \nabla \times \mathbf{F}$.

    (b) Show the divergence of your answer in (a) is 0, i.e.

$$\nabla \bullet (\nabla \times \mathbf{F}) = 0\ .$$