Arab Academy for Science, Technology & Maritime Transport

College of Engineering &Technology

Final Examination Paper

Department	Basic & Applied Science	**Date**	15/01/2011
Lecturer	Mathematics Group	**Marks**	40
Course Title	Mathematics 1	**Time Allowed**	2 hours
Course Code	BA123	**Start Time**	09:00-11:00

Find $\frac{dy}{dx}$ for each of the following functions (From Q1 to Q3):

Q1. $y=\left(\frac{2x^2-5}{3x^2+5}\right)^{7/2}$.

Q2. $y=x^3\sin^{-1}\left(\sqrt{x}\right)-2\cot^{-1}\left(x^2\right)$.

Q3. $y=\sqrt[4]{\frac{(1-x)^3\tanh^{-1}(x)}{x^x\sec\left(x^3\right)}}$.

Q4. **If** $x=t+\frac{1}{t}$ **and** $y=t^2+\frac{1}{t^2}$ **, Show that** $y''=2.$

Evaluate the following limits (From Q5 to Q6):

Q5. $\lim_{x\to 0}\left(1+\sin(5x)\right)^{1/x}$.

Q6. $\lim_{x\to\pi}\frac{1-\sin\left(x/2\right)}{\pi-x}$.

Q7. **Find the nth derivative for** $y=\frac{2x+1}{x-1}$.

Q8. Using Maclaurin's expansion, Show that
$\frac{e^{-x}}{1-x}=1+\frac{x^2}{2}+\frac{x^3}{3}+\frac{3x^4}{8}+\cdots$.

Q9. If $z = \ln\left(x^2 + y^2\right)$, show that $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0$.

Q10. For the curve $y = x^3 - 6x^2 + 10$, find

(a) The critical points.
(b) The intervals in which the curve is increasing and decreasing.
(c) The local maximum and minimum points.
(d) The inflection point.
(e) The concavity of the curve.

Finally, sketch the curve.

Q11. Discuss and sketch the curve $y^2 - 4x - 4y + 12 = 0$.