MATH135 S115
Mathematics IA
Assignment 1

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Tutorial Group: D2, Wed 15:00, C5C 238
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Due 14:00, 02/04 2015

Please sign the declaration below, and staple this sheet to the front of your solutions. Your assignment must be submitted at the Science Centre, E7A Level 1.

Your assignment must be STAPLED, please do not put it in a plastic sleeve.

PLAGIARISM Plagiarism involves using the work of another person and presenting it as one's own. For this assignment, the following acts constitute plagiarism:

a) Copying or summarizing another person's work.
b) Where there was collaborative preparatory work, submitting substantially the same final version of any material as another student.

Encouraging or assisting another person to commit plagiarism is a form of improper collusion and may attract the same penalties.

STATEMENT TO BE SIGNED BY STUDENT

1. I have read the definition of plagiarism that appears above.
2. In my assignment I have carefully acknowledged the source of any material which is not my own work.
3. I am aware that the penalties for plagiarism can be very severe.
4. If I have discussed the assignment with another student, I have written the solutions independently.

SIGNATURE .....

FEEDBACK		
Work	**Presentation**	**Total**

1. Find the exact values of $\sin\dfrac{7\pi}{12}$ and $\cos\dfrac{7\pi}{12}$. Do not use a calculator, and explain your reasoning carefully.

2. A picture supposedly painted by the Flemish painter Pieter Bruegel the Elder ($\pm$ 1525–1569) contains currently 97.5% of its carbon-14 (half-life 5730 years). From this information decide whether the picture is a fake. Explain your reasoning.

3. (Hughes-Hallett *et al*, 2013) The power output, P, of a solar panel varies with the position of the sun. Let $P(\theta) = 10\sin\theta$ Watts, where θ is the angle between the sun's rays and the panel, $0 \le \theta \le \pi$. On a typical summer day in Ann Arbor, Michigan, the sun rises at 6 am and sets at 8 pm and the angle is $\theta(t) = \pi t/14$, where t is time in hours since 6 am and $0 \le t \le 14$.

   (a) Write a formula for a function, $f(t)$, giving the power output of the solar panel (in watts) t hours after 6 am on a typical summer day in Ann Arbor.

   (b) Graph the function $f(t)$ in part (a) for $0 \le t \le 14$.

   (c) At what time is the power output greatest? What is the power output at this time?

   (d) On a typical winter day in Ann Arbor, the sun rises at 8 am and sets at 5 pm. Write a formula for a function, $g(t)$, giving the power output of the solar panel (in watts) t hours after 8 am on a typical winter day.

4. Calculate $\displaystyle\lim_{x\to-\infty}\frac{3x^3+x^2+42}{3|x|^3+|x|+1}$ if it exists. Check your result on an appropriate graph of the function.

5. For t in months, a population, in thousands, is approximated by a continuous function

$$P(t) = \begin{cases} e^{kt} & 0 \le t \le 12 \\ 1000 & t > 12\,. \end{cases}$$

   (a) What is the initial value of the population?

   (b) What must be the value of k?

   (c) Describe in words how the population is changing.