THE UNIVERSITY OF BRITISH COLUMBIA

Science 1 Math/Phys

Second Midterm

19 November 1998

TIME: 50 MINUTES

FULL NAME: ______________________ STUDENT # : ______________

SIGNATURE: ______________________

This Examination paper consists of 7 pages (including this one). Make sure you have all 7.

INSTRUCTIONS:

Write your name on every sheet.

One page of "memory aids" is allowed. If you use one, turn it in with your paper!

Read carefully! Familiar questions may have changed subtly....

MARKING:

Q1	/30
Q2	/30
Q3	/40
TOTAL	/100

NAMES OF INSTRUCTORS: Mark MacLean, Jess H. Brewer & Domingo Louis-Martinez

Q1 Sketch The Function [30 marks]

Sketch the graph of $y = 5x^3 + 2x + \dfrac{1}{x}$.

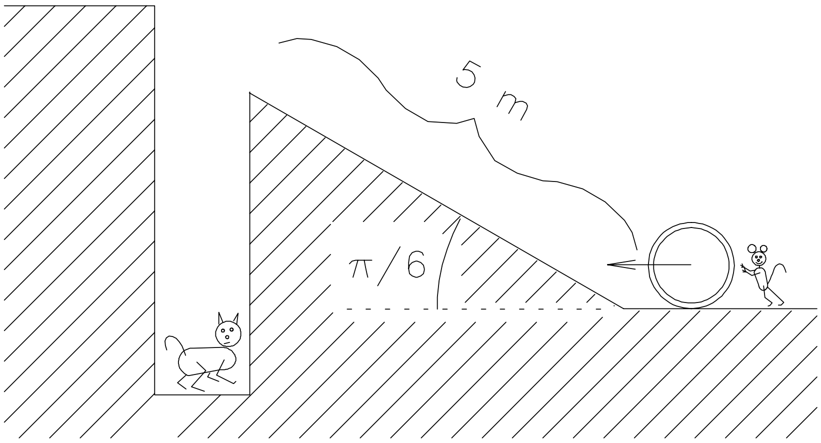
Show all work related to your sketching process.

YOUR FULL NAME:

(extra work space for the question on the preceding page)

YOUR FULL NAME:

Q2 Itchy & Scratchy [30 marks]



Scratchy the cat is trapped at the bottom of a shaft as shown. Itchy the mouse gives a large thin-walled cylindrical shell of radius 0.5 m a push toward the ramp, letting go when it is at the bottom of the ramp. If the initial angular velocity $\omega_\circ$ is 10 rad/s, who will get squashed? (Will the cylinder make it to the top and fall down on Scratchy, or roll back onto Itchy?) Assume that the cylinder rolls without slipping.

(extra work space for the question on the preceding page)

Q3 "Quickie" Questions [40 marks]

(a) **Mathematics Quickies** [20 marks]

$$\frac{dx}{dt} = -3\,x \qquad \text{and} \qquad x(0) = 2\,.$$

i) What is $x(t)$?

ii) Write down the formula for the n^{th} iteration of Euler's method for this case.

iii) What kind of error do you expect if you use a timestep of $h = 0.1$ for the interval $0 \le t \le 1$? Explain.

YOUR FULL NAME:

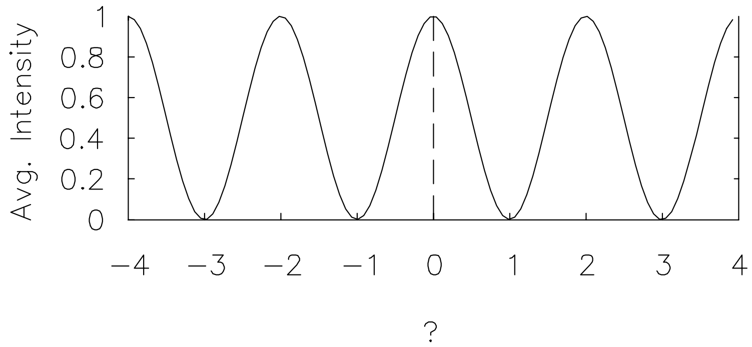
(*b*) **Physics Quickies** [20 marks]

i) [8 marks] Which of the following features are *essential* for SIMPLE HARMONIC MOTION? (Circle your answers.)

A linear restoring force. $\dot{x} = -kx$. Newton's First Law.

Viscous damping. A quadratic potential minimum. A spring.

$\ddot{x} = -\omega^2 x$. A driving force at the resonant frequency.



The figure above shows the average intensity of "some combination of waves" plotted vertically as a function of [some variable] plotted horizontally.

ii) [6 marks] If the horizontal variable is a **spatial angle** θ (measured in *milliradians* [mr]), what phenomenon does this pattern describe and what can you tell about the sources of the waves that make it up?

iii) [6 marks] If the horizontal variable is **time** t (measured in *seconds* [s]), what phenomenon does this pattern describe and what can you tell about the sources of the waves that make it up?

YOUR FULL NAME: