

Simon Fraser University
Department of Mathematics
Burnaby Campus

MATH 151, Summer 2006
Midterm 2
July 5th, 2006, 8:30 – 9:20

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|----------------------------|----------------|
| Last Name (please print): | |
| First Name (please print): | |
| Student ID: | |
| Instructor: | Keshav Mukunda |

Instructions:

1. DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO.
2. Fill in the above box.
3. This exam contains 9 pages (including this cover page) with a total of 5 questions. Once the exam begins please check to make sure your exam is complete.
4. SHOW ALL YOUR WORK! No credit will be given for just writing down the answer.
5. If you run out of space in a problem, use the space on the back of the previous page and clearly indicate where the solution continues.
6. **Only** scientific, non-programmable calculators with no differentiation and integration capabilities are allowed.
7. No book, paper, or device, other than the usual writing instruments, this booklet and an acceptable calculator, shall be within reach of a student during the examination.

8. During the examination, speaking to, communicating with, or deliberately exposing written papers to the view of other examinees is forbidden.

| Do not write in this table! | |
|-----------------------------|------------|
| Question | Marks |
| 1 | /7 |
| 2 | /4 |
| 3 | /7 |
| 4 | /5 |
| 5 | /7 |
| Total | /30 |

Q1.

Evaluate the following derivatives. Your final answer must be expressed only in terms of x .

(a) [2 marks] y' , if $y = \ln(3 \cosh x)$.

(b) [3 marks] y' , if $y = x^{\sqrt{x} \ln x}$ where $x > 0$.

Q1. (continued)

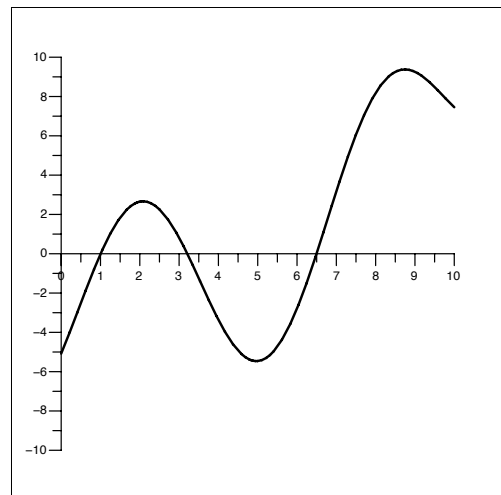
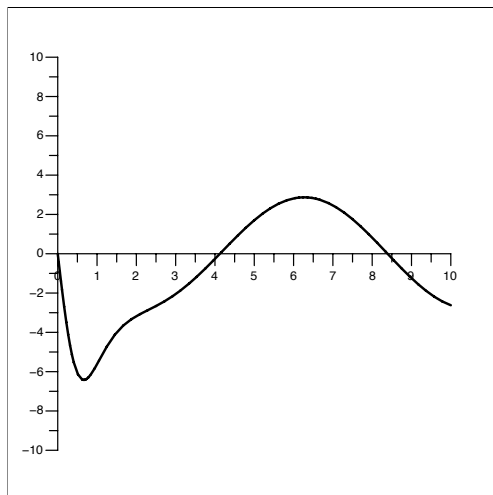
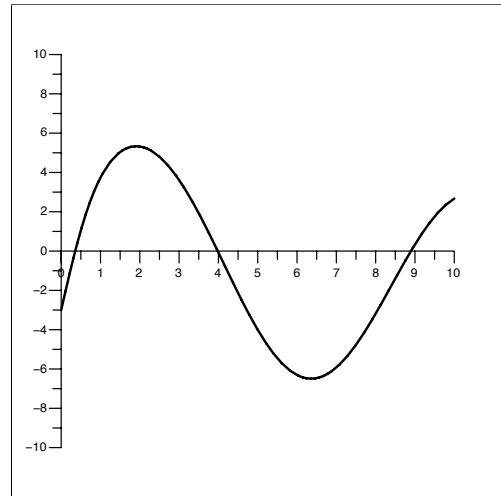
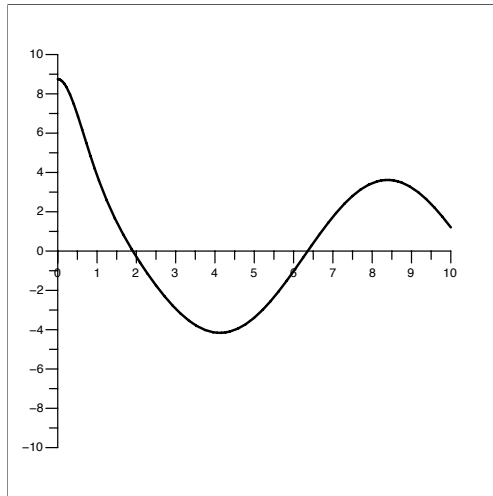
Evaluate the following derivative by finding the first few derivatives and observing the pattern.

(c) [2 marks] $g^{(41)}(x)$, when $g(x) = \cos(x/3)$

Q2.

[4 marks] The graphs of four functions are given below. One represents the position function of an object, one is its velocity, and one is its acceleration. Identify each of the three graphs and fill in the spaces below with your choice of a , b , c or d . (No explanation is required.)

Position: _____ Velocity: _____ Acceleration: _____

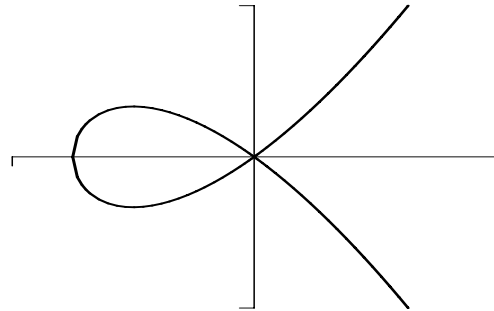


Q3.

In this question we consider the curve given by the equation

$$y^2 = x^3 + 3x^2$$

The graph of this curve is shown on the right.



(a) [3 marks] Use implicit differentiation to find y' .

(b) [1 mark] At what point(s) does this curve have a horizontal tangent?

Q3. (continued)

(c) [1 mark] At what point(s) does this curve have a vertical tangent?

(d) [2 marks] Find the equations of the two tangent lines to this curve at the point $(0, 0)$.

Q4.

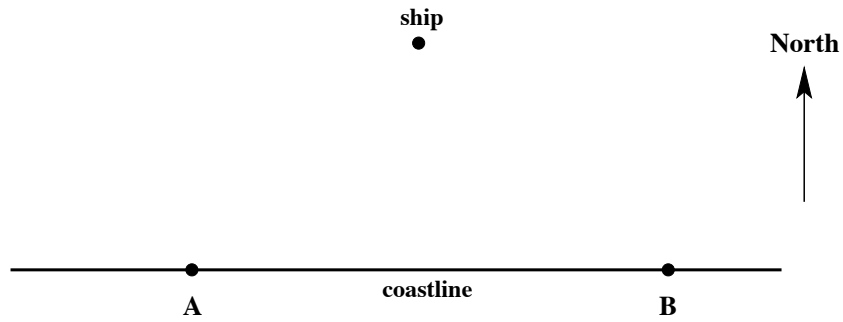
This question concerns the function $f(x) = x^{2/3} (4 - x^2)$.

(a) [3 marks] Find the critical numbers of $f(x)$.

(b) [2 marks] Find the absolute maximum and minimum values of f over the interval $[-2, 3]$.

Q5.

Two radar stations are positioned at A and B along a straight line coast, with B 24 km east of A. Both radar stations are tracking a ship that is north of the two stations. The ship is travelling east at 3 km/h.



(a) [1 mark] At a certain instant, the ship is 13 km from A, and this distance is increasing at the rate of 2 km/h. At the same instant, the ship is also 13 km from B. How far north and east of A is the ship located?

Q5. (continued)

(b) [6 marks] At the same instant as in part (a), what is the rate at which the distance from the ship to the station at B is changing? Is this distance increasing or decreasing?