

MATH6103 Differential & Integral Calculus
MATH6500 Elementary Mathematics for Engineers

Problem Sheet 4

Deadline: **Monday 2 November, 5:00.**

Hand in to **drop box 5** in the undergraduate common room (maths department, room 502).

Hand in the questions marked with an asterisk (*).

One mark will be deducted if you do not **staple your work.**

1) Find $\frac{dy}{dx}$ when:

a) $y = \sin^{-1} x$

* e) $y = e^x + 4^x$

* b) $y = \ln x + \sec x$

f) $y = \ln(x^4)$

c) $y = \sin^{-1}(e^x)$

g) $y = 4 \ln x$

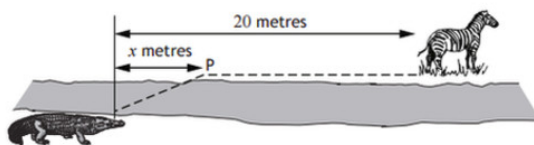
d) $y = \frac{1}{\ln x}$

g) $y = x^x$

2) A crocodile is stalking prey located 20 metres further upstream on the opposite bank of a river.

Crocodiles travel at different speeds on land and in water.

The time taken for the crocodile to reach its prey can be minimised if it swims to a particular point, P , x metres upstream on the other side of the river as shown in the diagram.



The time taken, T , measured in tenths of a second is given by

$$T(x) = 5\sqrt{36 + x^2} + 4(20 - x)$$

Calculate:

- * a) the time taken if the crocodile does not travel on land.
- * b) the time taken if the crocodile swims the shortest distance possible.
- * c) the value of x such that the time T is minimised and hence the minimum possible time.