SYDNEY BOYS' HIGH SCHOOL

TERM 4 ASSESSMENT TASK 1995

3 UNIT

TIME: 70 Minutes.

INSTRUCTIONS:

* Show all necessary working.
* Marks may be deducted for untidy or poorly arranged work.
* Approved calculators may be used.
* SUBMIT ANSWERS IN 4 SECTIONS ie Q1, Q2, Q3, Q4.

Set By: P. Bigelow.

Question 1 (13 marks) **Marks**

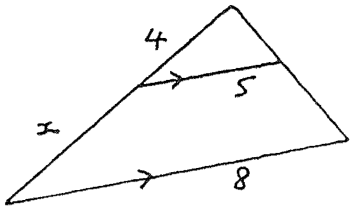
(a) For what values of x is the function given by $f(x) = x^3 - 3x^2 + 4$ **[3]**

(i) increasing

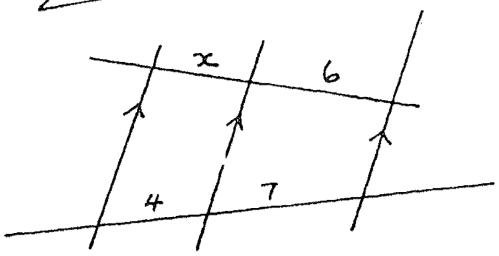
(ii) concave upwards

(b) Find the value of c such that the points (4,1), (-1,5) and (3,c) are collinear. **[2]**

(c) (i) Find the value of x in each of the following (give a brief reason). **[4]**



(ii)



(d) Explain why it is impossible to have a regular polygon with an interior angle of 164°. **[2]**

(e) The equation of the tangent to the curve $y = x^3 - 4x$ at the point where $x = \frac{-2}{\sqrt{3}}$ is:- **[2]**

A: $y = x + 1$ B: $y = 0$ C: $y = \frac{16}{3\sqrt{3}}$ D: none of these

Question 2 (12 marks) **Marks**

(a) Find the second derivative of $y = \frac{2x - 1}{1 + 2x}$ [2]

(b) ABCO is a parallelogram where A is (1,6), C is (4,2) and O is the origin. [2]

Find the co-ords of B.

(c) The equation of a curve is $y = x^3 + 2x^2 + cx + 36$ where c is a constant [8]

(i) Write down an expression for $\frac{dy}{dx}$

(ii) P is a turning point on the curve. Given that x co-ordinate of P is 5/3, find the value of c.

(iii) Find the co-ordinates of the second turning point Q on this curve.

(iv) Determine which of the points P,Q is a maximum and which is a minimum.

Question 3 (10 marks)

(a) Find the equation of the normal to the curve $y = x^3 - 6x + 7$ at the point where $x = 2$. [3]

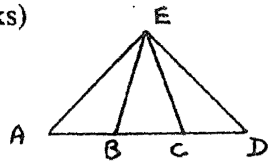
(b) Make a sketch of a continuous and differentiable function in the domain $1 \leq x \leq 8$ which has the following features [2]
$f(1) = 3$, $f(8) = 7$ and $f''(x) < 0$.

(c) Use co-ordinate geometry to prove that the line joining the mid-points of two sides of a triangle is half the third side. [3]
[HINT let the vertices be (0,0) (a,o) and (b,c,)]

(d) Find any points of inflexion on the curve $y = x^{\frac{1}{3}}$ [Justify your answer] [2]

..../4

Question 4 (15 marks) Marks

(a) 

$\triangle ABD$ is isosceles, AC = DB. [3]
prove that $\triangle ABE \equiv \triangle DCE$

(b) In a drafting business it has been found that the efficiency, E percent, of an employee after H hours of work on a given day may be represented by the equation $E = 50 + 24H - 3H^2$ [3]

(i) Determine the number of hours of work required to reach maximum efficiency.

(ii) What is the maximum efficiency?

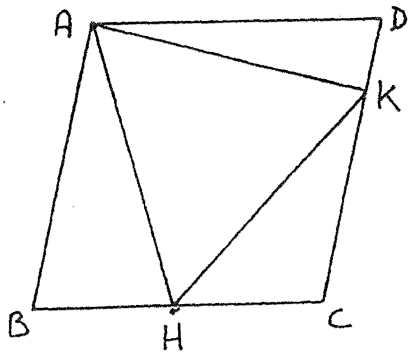
(c) The function $y = f(x)$ has the following features $f(1) = 0$ and $f'(x) = (x - 1)(x + 2)^2$ [5]

(i) Find the equation of the function.

(ii) Find any stationary points and points of inflexion.

(iii) For what values of k will the equation have no real solutions? below

$x^4 + 4x^3 - 16x + 11 = k$ (Hint sketch $y = f(x)$)

(d) 

ABCD is a rhombus, [4]
AB = AH = AK = HK. Find the measure of angle BAD