Question 1 Show all working (18 marks) **(Marks)**

(a) For the parabola with equation $(x-3)^2 = 12y + 24$ find: **(2)**

(i) the vertex

(ii) the focus

(b) A bag contains 8 green discs and 6 red discs identical to each other except for colour. **(2)**
One disc is drawn at random, its colour noted, and it is then set aside. A second disc is then drawn.
Find the probability that:

(i) both discs are green

(ii) at least 1 disc is red

(c) The quadratic equation $2x^2 - 3x + 8 = 0$ has solutions given by α and β. **(2)**
Evaluate:

(i) $\alpha + \beta$

(ii) $\frac{1}{\alpha} + \frac{1}{\beta}$

(d) Draw two separate sketches to represent a section of curve $y = f(x)$ which satisfies **(4)**
the following conditions:

(i) domain $-3 \le x \le 3$, range $1 \le y \le 5$, $f(-3) = 3$, $f(3) = 5$ and $f'(1) = 0$

(ii) $f'(-2) = f'(2) = f''(0) = 0$, $f''(-2) < 0$, $f''(2) > 0$, $f(-2) = 6$ and $f(2) = -4$

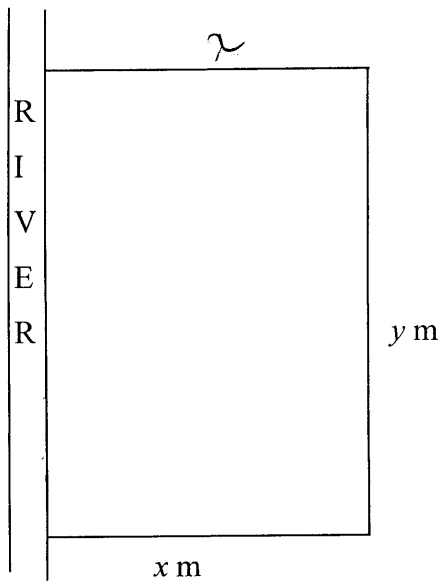
max min

$y = f(x)$ $f'(1) = 0$

$x = -3$, $y = 3$ $x = 1$, $y = 0$

(Marks)

(e) A section of paddock with a straight river running along one side is to be fenced using 100m of fencing. The section fenced is in the shape of a rectangle with a length y m and a width x m as shown. The side along the river does not need to be fenced. **(4)**



(i) Express y in terms of x.

(ii) Find an expression, in terms of x, for the area of this field.

(iii) Find the dimensions of this field so that the area it contains is a maximum

(f) Given that $\frac{dy}{dx} = (5x - 1)^3$ and that if $x = 3$, $y = 4$, find the value of y if $x = 0$. **(2)**

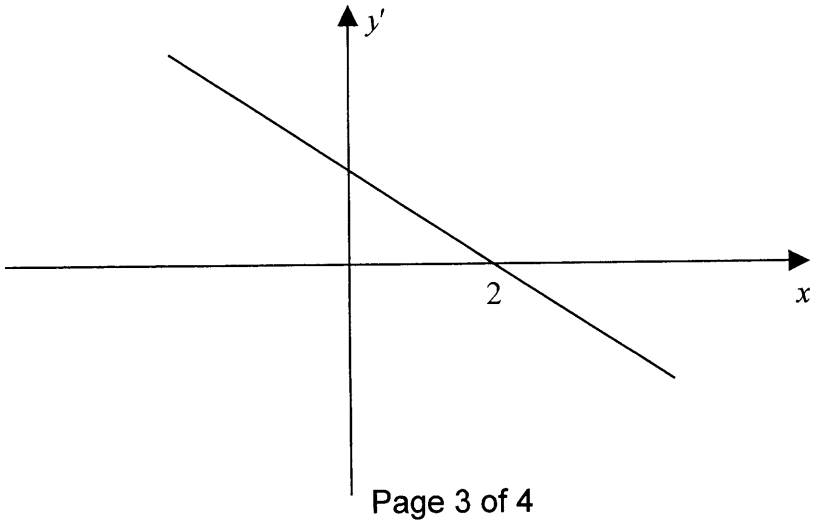
(g) The equation $y(y - 4) = 4(2x - 7)$ represents a parabola. **(2)**

Determine the equation of its directrix.

Question 2 Show all working (Start a new page) **18 marks**

(a) Given that $f'(x) = 9\sqrt{x}$, find an expression for $f(x)$ **(1)**

(b) The function drawn below is a gradient function. Copy or trace this gradient function and on the same axes draw a sketch of a function which could have led to this gradient function. **(2)**



(c) Two players are playing a game with two dice. They take turns to roll the two dice to produce a score. A score is found by multiplying the difference between the uppermost faces on the two dice by the higher of the two uppermost faces. **(4)**

(i) Find the probability that on the first turn, a player scores a score of 12.

(ii) Find the probability that on any given throw, a score of at least 12 is achieved.

(iii) If a player scores zero, they are allowed to have the next turn. Find the probability that a given player has **exactly** 4 turns in a row.

(d) Solve $3x^2 < 4x$ **(2)**

$3x - 4 = 0$

$3x = 4$

$x = \frac{4}{3}$

(e) For the function $y = 2x^3 - 6x^2 - 48x + 10$ **(5)**

$-128 - 96 + 192$

(i) Find the stationary points and determine their nature.

(ii) Find the co-ordinates of the point of inflexion, and explain why it is a point of inflexion.

(iii) Use the information from parts (i) and (ii) and anything else you consider necessary to sketch this function for the domain $-4 \leq x \leq 5$.

125

$250 - 150 + 240$

(f) The point P(x,y) moves such that PA $\perp$ PB. Given that A and B have co-ordinates $(-1, 2)$ and $(7, 6)$ respectively, find the locus of P in algebraic form and describe this locus geometrically in detail. **(4)**

$x = 4, -2$

$y' = 6x^2 - 12x - 48$

End of Paper