Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines if necessary.

1. [Maximum mark: 6]

The following table shows the probability distribution of a discrete random variable X.

X	**0**	**1**	**2**	**3**
$P(X=x)$	$\dfrac{3}{13}$	$\dfrac{1}{13}$	$\dfrac{4}{13}$	k

(a) Find the value of k.   [3]

(b) Find $E(X)$.   [3]

3. [Maximum mark: 6]

Consider the function $f(x) = \dfrac{3x+1}{x-2}$, $x \neq 2$.

(a) For the graph of f,

    (i)   write down the equation of the vertical asymptote;

    (ii)   find the equation of the horizontal asymptote. [3]

Let $g(x) = x^2 + 4$, $x \in \mathbb{R}$.

(b) Find $(f \circ g)(1)$. [3]

3.   [Maximum mark: 7]

Let $f(x) = \dfrac{6x-1}{2x+3}$, for $x \neq -\dfrac{3}{2}$.

(a)   For the graph of f,

   (i)   find the y-intercept;

   (ii)   find the equation of the vertical asymptote;

   (iii)   find the equation of the horizontal asymptote.   [5]

(b)   Hence or otherwise, write down $\displaystyle\lim_{x \to \infty}\left(\dfrac{6x-1}{2x+3}\right)$.   [2]

11. Consider the curve $y = 5x^3 - 3x$.

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. [2]

The curve has a tangent at the point $\mathrm{P}(-1, -2)$.

(b) Find the gradient of this tangent at point P. [2]

(c) Find the equation of this tangent. Give your answer in the form $y = mx + c$. [2]

Working:

Answers:

(a) . . . .

(b) . . . .

(c) . . . .

3. [Maximum mark: 6]

Consider the function $f(x) = x^2 e^{3x}$, $x \in \mathbb{R}$.

(a) Find $f'(x)$. [4]

(b) The graph of f has a horizontal tangent line at $x = 0$ and at $x = a$. Find a. [2]