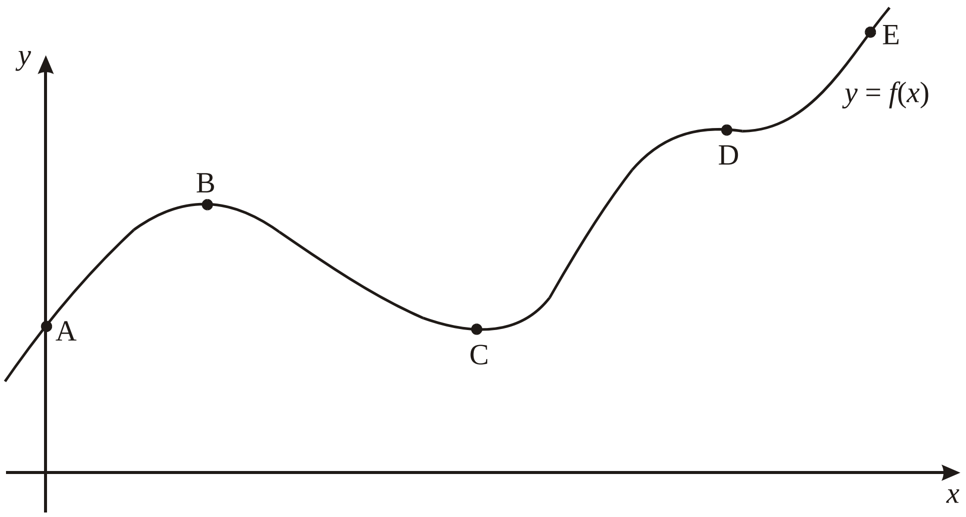
1. A, B, C, D and E are points on the curve $y = f(x)$ shown in the diagram below.



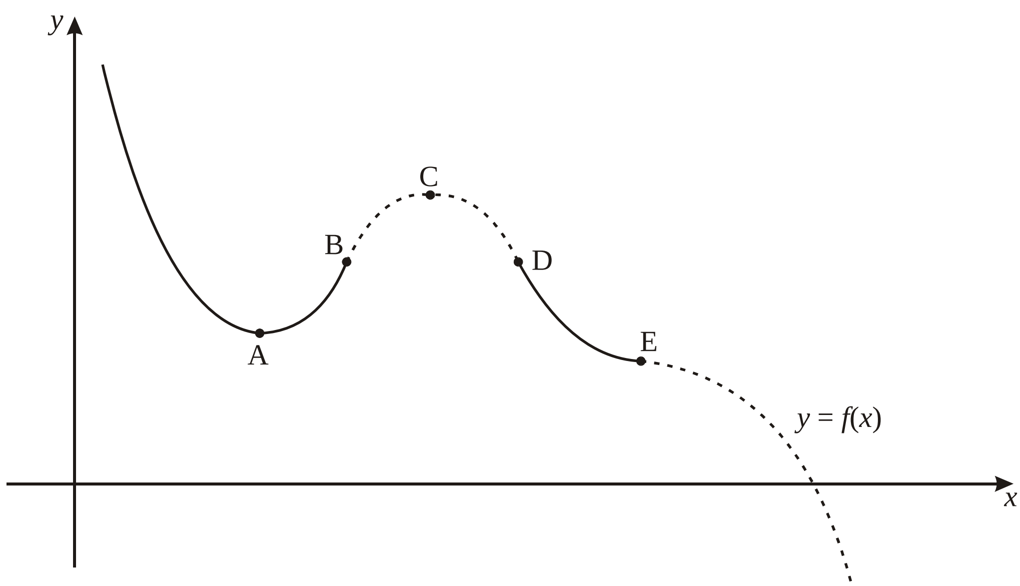
(a) Describe the gradient of the curve in passing from the point B, through point C to point D.

(3)

(b) D has coordinates $(a, f(a))$, and the x-coordinate at E is $a + 4$. Write an expression for the gradient of the line segment [DE].

(3)
(Total 6 marks)

2. The letters A to E are placed at particular points on the curve $y = f(x)$.



(a) What is the gradient of the curve $y = f(x)$ at the point marked C?

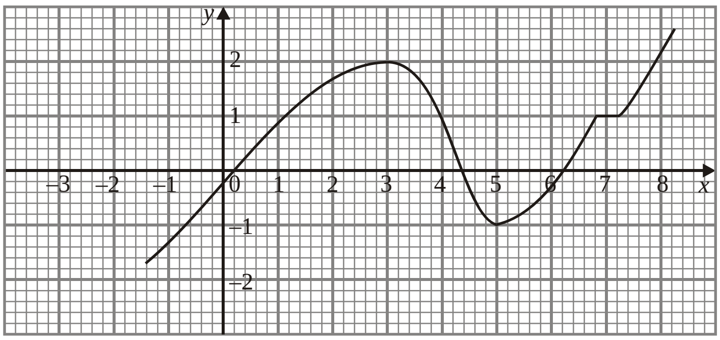
(1)

(b) In passing from point B, through point C, to point D what is happening to $\frac{dy}{dx}$? Is it decreasing or increasing?

(2)

(Total 3 marks)

3. The diagram shows a part of the curve $y = f(x)$.



(a) For what values of x is $f'(x) = 0$?

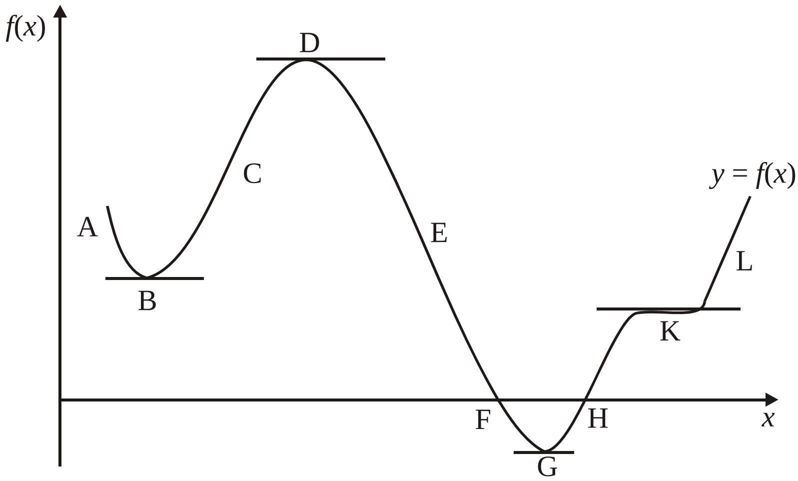
(3)

(b) For what range of values of x is $f'(x) < 0$?

(2)

(Total 5 marks)

4.



Given the graph of $f(x)$ state

(a) the intervals from A to L in which $f(x)$ is increasing.

(1)

(b) the intervals from A to L in which $f(x)$ is decreasing.

(1)

(c) a point that is a maximum value.

(1)

(d) a point that is a minimum value.

(1)

(e) the name given to point K where the gradient is zero.

(1)
(Total 5 marks)

5. The function $f(x)$ is given by the formula

$$f(x) = 2x^3 - 5x^2 + 7x - 1$$

(a) Evaluate $f(1)$.

(2)

(b) Calculate $f'(x)$.

(3)

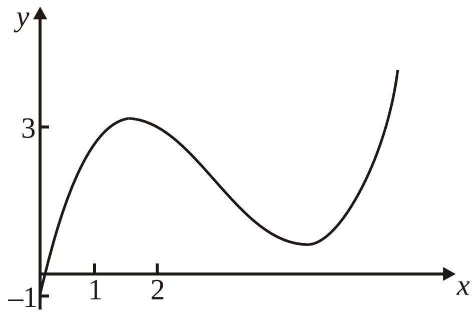
(c) Evaluate $f'(2)$.

(2)

(d) State whether the function $f(x)$ is increasing or decreasing at $x = 2$.

(1)

(e) The sketch graph shown below is the graph of a cubic function.



(i) Is it possible that this is the graph of the function $f(x)$ above?

(ii) State one reason for your decision.

(2)
(Total 10 marks)

1. (a) At B, the gradient is zero.
From B to C, the gradient is negative.
At C, the gradient is zero.
From C to D, the gradient is positive.
At D, the gradient is zero. (A3) 3

Note: *Award [½ mark] for each correct statement and round up.*

(b) Gradient = $\dfrac{y_2 - y_1}{x_2 - x_1}$

$= \dfrac{f(a+4) - f(a)}{(a+4) - (a)}$ (M2)

Note: *Award (M1) for f(a + 4)*

$= \dfrac{f(a+4) - f(a)}{4}$ (A1) 3

[6]

2. (a) $\frac{dy}{dx} = 0$ at point C (A1) 1

(b) $\frac{dy}{dx}$ changes from +ve to –ve and is decreasing (A2) 2

Notes: *Award (A1) for "+ve to –ve" and, (A1) for "decreasing".*
Accept equivalent answers, e.g. "decreasing, becomes zero, and then begins to increase negatively".

[3]

(a) Describe the gradient of the curve in passing from the point B, through point C to point D.

(3)

(b) D has coordinates (a, $f(a)$), and the x-coordinate at E is $a + 4$. Write an expression for the gradient of the line segment [DE].

(3)
(Total 6 marks)

3. (a) $x = 3$ (A1)
$x = 5$ (A1)
$x = 6.8 – 7.2$ (A1) 3

(b) $3 < x < 5$ (A1)(A1)
[5]

4. (a) B $\rightarrow$ D, G $\rightarrow$ L (or G $\rightarrow$ K and K $\rightarrow$ L) (both correct) (accept C, H, L) (A1) 1

(b) A $\rightarrow$ B, D $\rightarrow$ G (both correct) (accept A, E, F) (A1) 1

(c) D (A1) 1

(d) B or G (accept either) (A1) 1

(e) Point of inflexion (A1) 1
[5]

5. (a) Substitute $x = 1$ into $f(x)$, $f(1) = 3$. (M1)(A1)
or (G2) 2

(b) $f'(x) = 6x^2 – 10x + 7$ (A1)(A1)(A1)

Note: *If the –1 is left in and written separately then the constant is wrong so max possible is (A2).*

(c) Substitute $x = 2$ into (b) $f'(2) = 11$. (M1)(A1)
or (G2) 2

Note: *No ft here if original f(x) is just written as answer for (b).*

(d) Increasing. (A1) 1

(e) (i) No. (A1)

(ii) Because the gradient at $x = 2$ is wrong (or wrong sign) or **any other valid reason** (*eg* $f(x)$ has an inflection not a max/min), (but note that $f(1)$ and $f(0)$ both agree, and both the formula and the graph have a single real root near to 0, so none of these is a valid reason).
A sketch of the graph from the GDC with no detailed reason can be awarded ***(G1)*** if it is reasonable. (R1) 2

[10]