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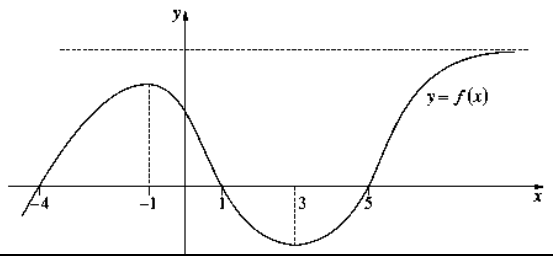
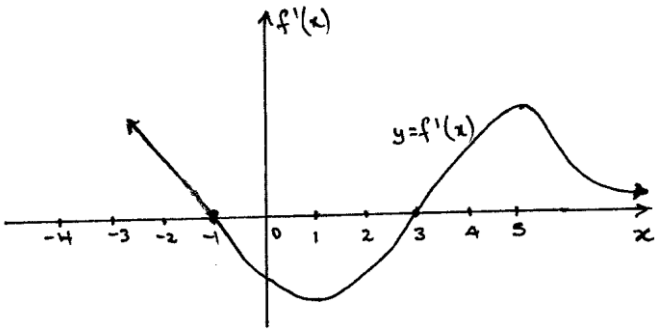
|---|---|---|---|
| **09** | **8a** | The diagram shows the graph of a function $y = f(x)$.<br>(i) For which values of $x$ is the derivative, $f'(x)$, negative?<br>(ii) What happens to $f'(x)$ for large values of $x$?<br>(iii) Sketch the graph of $y = f'(x)$.<br>  | **1**<br>**1**<br>**2** |

(i) $f'(x) < 0$ when curve is decreasing:
$-1 < x < 3$.

(ii) As $x \to \infty$, then the curve is flattening out.
This means $f'(x) \to 0$.

(iii)

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**Board of Studies: Notes from the Marking Centre**

Overall, many candidates did not have a deep and clear understanding of the relationship between a curve and its gradient function. Instead of looking at the value of $f'(x)$, the candidates were trying to describe the features of $f(x)$ and drew an incorrect graph.

(i) Most of the candidates were aware of the regions where $f'(x)$ was negative but they included the stationary points in their solution, writing $-1 \le x \le 3$. Some candidates gave the values of $-1$ and 3 for $x$, and many offered answers for where $f(x)$ was negative, which indicated poor comprehension of the question.

(ii) This part was poorly answered. Most candidates stated what happened to $f(x)$ rather than $f'(x)$ as $x$ approached infinity. They were confused by the horizontal asymptote in the graph and stated that as $x$ approached infinity, $f'(x)$ approached an asymptote or a constant $y$ value.

(iii) Most candidates who attempted this part were able to gain a mark by drawing a concave-up parabola with intercepts at $x = -1$ and $x = 3$. Most candidates were unable to determine what happened to the graph as $x$ gets smaller and also when $x$ gets larger. Most graphs were poorly drawn with very little attention to accuracy, axes were not labelled and scales were poorly done. Few candidates were able to get full marks.

**Source:** http://www.boardofstudies.nsw.edu.au/hsc_exams/

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