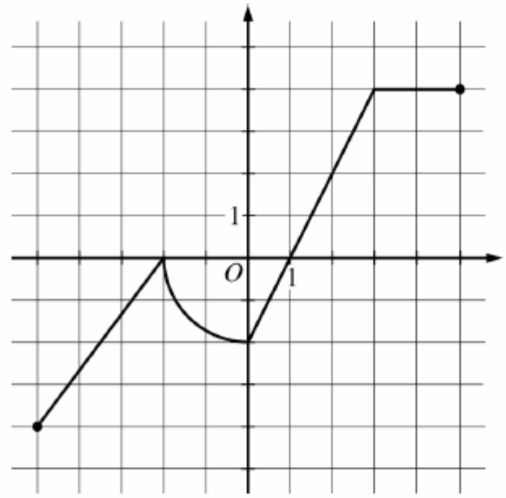
NO CALCULATOR IS ALLOWED FOR THIS QUESTION.



Graph of f

3. The graph of the function f, consists of three line segments and a quarter of a circle, is shown above. Let g be the function defined by $g(x) = \int_1^x f(t)dt$.

(a) Find the average rate of change of g from $x = -5$ to $x = 5$.

(b) Find the instantaneous rate of change of g with respect to x at $x = 3$, or state that it does not exits.

(c) On what open intervals, if any, is the graph of g concave up? Justify your answer.

(d) Find all $x-$values in the interval $-5 < x < 5$ at which g has a critical point as the location of a local minimum, or local maximum, or neither. Justify your answers.

NO CALCULATOR IS ALLOWED FOR THIS QUESTION.

4. Consider the curve given by the equation $2(x - y) = 3 + \cos y$. For all points on the curve, $\frac{2}{3} \leq \frac{dy}{dx} \leq 2$.

(a) Show that $\frac{dy}{dx} = \frac{2}{2 - \sin y}$.

(b) For $-\frac{\pi}{2} < y < \frac{\pi}{2}$, there is a point P on the curve through which the line tangent to the curve has slope 1. Find the coordinates of the point P.

(c) Determine the concavity of the curve at points which $-\frac{\pi}{2} < y < \frac{\pi}{2}$. Give a reason for your answer.

(d) Let $y = f(x)$ be a function, defined implicitly by $2(x - y) = 3 + \cos y$, that is continuous on the closed interval $[2, 2.1]$ and differentiable on the open interval $(2, 2.1)$. Use the Mean Value Theorem on the interval $[2, 2.1]$ to show that $\frac{1}{15} \leq f(2.1) - f(2) \leq \frac{1}{5}$.