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Question Number: **3**

a)

i) $A(-2,-4)$ $B(12,6)$

$$M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$= \left(\frac{-2+12}{2}, \frac{-4+6}{2}\right)$$

$$= \left(\frac{10}{2}, \frac{2}{2}\right) = (5,1)$$

$$\therefore M = (5,1)$$

ii) $B\overset{x_1}{(12,6)}$ $C\overset{x_2}{(6,8)}$

$$m = \frac{y_2-y_1}{x_2-x_1} = \frac{8-6}{6-12} = -\frac{2}{6} = -\frac{1}{3}$$

iii)   In $\triangle ABC$ and $\triangle AMN$

$\angle A$ is common

~~NM bisects AC and AB~~

AM is in the same proportion as MB

AN is in the same proportion as CN

$\therefore \triangle ABC \;|||\; \triangle AMN$ (SAS)

iv) $M(5,1)$ $N(2,2)$

$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{2-1}{2-5} = \dfrac{-1}{3} = \dfrac{1}{3}$

$y - y_1 = m(x - x_1)$

$y - 1 = \frac{1}{3}(x - 5)$

$3y - 3 = x - 5$

$x - 3y - 2 = 0$

v) $B(12,6)$ $C(6,8)$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$\quad = \sqrt{(6-12)^2 + (8-6)^2}$

$\quad = \sqrt{36 + 4}$

$\quad = \sqrt{40} \qquad = \sqrt{4} \times \sqrt{10}$

$\qquad\qquad\qquad = 2\sqrt{10} \text{ units}^2$

vi) $\dfrac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$

$\qquad\quad M_{BC} = -\frac{1}{3}$

$y - y_1 = m(x - x_1)$

$y - 8 = -\frac{1}{3}(x - 12)$

$3y + 18 = -x + 12$

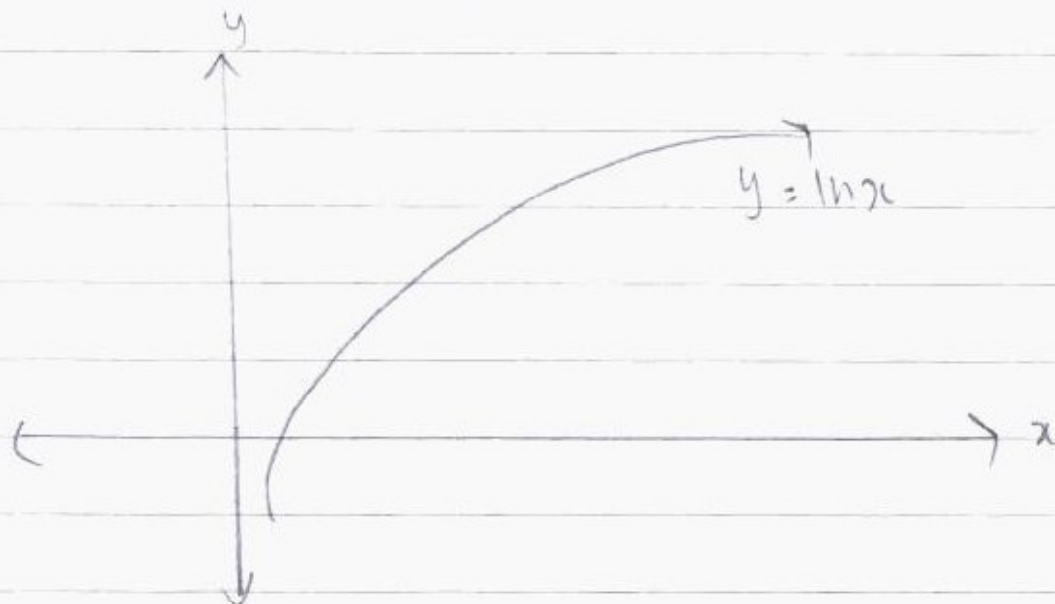$x + 3y + 6 = 0$

$\dfrac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$

$\dfrac{|1(-2) + 3(-4) + 6|}{\sqrt{1^2 + 3^2}}$

$= \dfrac{|-2 - 12 + 6|}{\sqrt{5}}$

$= \dfrac{|-8|}{\sqrt{5}} = \dfrac{8}{\sqrt{5}}$

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b)   i) $y = \ln x$

$y = \ln x$

ii)

$$\int_1^3 \ln x \, dx$$

$$= \left[\frac{1}{x} \right]_1^3$$

$$= \left[\frac{1}{3} \right] - \left[1 \right)$$

$$= -\frac{2}{3} = \frac{2}{3}$$

iii)   greater than .