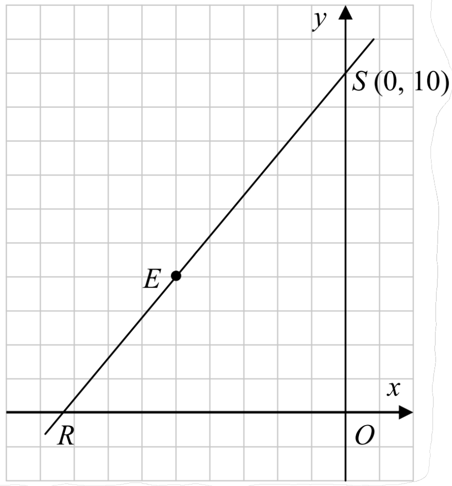
Question 5 **(25 marks)**

The line RS cuts the x-axis at the point R and the y-axis at the point $S(0, 10)$, as shown. The area of the triangle ROS, where O is the origin, is $\frac{125}{3}$.



(a) Find the co-ordinates of R.

(b) Show that the point $E(-5, 4)$ is on the line RS.

(c) A second line $y = mx + c$, where m and c are positive constants, passes through the point E and again makes a triangle of area $\frac{125}{3}$ with the axes. Find the value of m and the value of c.

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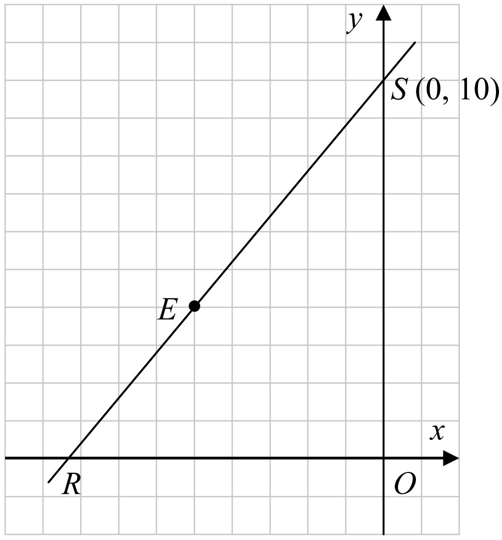

(a) Find the co-ordinates of *R*.

Area $ROS = \frac{1}{2}|RO|.|OS| = \frac{125}{3}$

$\Rightarrow \frac{1}{2}|RO|(10) = \frac{125}{3}$

$\Rightarrow |RO| = \frac{25}{3}$

$R\left(-\frac{25}{3}, 0\right)$

(b) Show that the point $E(-5, 4)$ is on the line *RS*.

Slope RS $= \dfrac{10-0}{0+\frac{25}{3}} = \dfrac{6}{5}$ Slope ES $= \dfrac{10-4}{0+5} = \dfrac{6}{5}$ Slope ER $= \dfrac{4-0}{-5+\frac{25}{3}} = \dfrac{6}{5}$

Any two slopes correct $\Rightarrow (-5, 4) \in RS$

Or

RS: $y-10 = \frac{6}{5}(x-0) \Rightarrow 6x-5y+50=0$

$6(-5)-5(4)+50 = -30-20+50 = 0 \Rightarrow (-5, 4) \in RS$

(c) A second line $y = mx + c$, where *m* and *c* are positive constants, passes through the point *E* and again makes a triangle of area $\frac{125}{3}$ with the axes. Find the value of *m* and the value of *c*.

$y = mx + c$ cuts x-axis at $P\left(-\frac{c}{m}, 0\right)$ and cuts y-axis at Q(0, c)

Area $\Delta POQ = \frac{1}{2}\left|0-\left(-\frac{c}{m}\right)c\right| = \frac{1}{2}\left|\frac{c^2}{m}\right| = \frac{125}{3} \Rightarrow m = \frac{3c^2}{250}$

$(-5, 4) \in y = mx + c \Rightarrow 4 = -5m + c \Rightarrow 4 = -5\left(\frac{3c^2}{250}\right) + c \Rightarrow 3c^2 - 50c + 200 = 0$

$\Rightarrow (3c-20)(c-10) = 0 \Rightarrow c = \frac{20}{3}$ or $c = 10$

$c = \frac{20}{3}$

Hence, $m = \dfrac{3c^2}{250} = \dfrac{3(\frac{20}{3})^2}{250} = \dfrac{400}{750} = \dfrac{8}{15}$

Question 5 **(25 marks)**

(a) Scale 10C (0, 3, 7, 10)
Low Partial Credit:
Relevant area of triangle formula

High Partial Credit:
- $|OR|$ found but x ordinate of R not stated
- Substantially correct work with one error

(b) Scale 10C (0, 3, 7, 10)
Low Partial Credit:
- Effort at finding one slope
- Effort at finding equation of *RS*

High Partial Credit:
- Relevant conclusion not stated or implied
- *E* inserted into equation of *RS* but relevant conclusion not stated or implied

(c) Scale 5C (0, 2 ,3, 5)
Low Partial Credit:
- Effort at finding intercept on one or both axes
- Effort at inserting $(-5,\ 4)$ into $y = mx + c$

High Partial Credit:
- Either *c* or *m* found