Question 5 **(25 marks)**

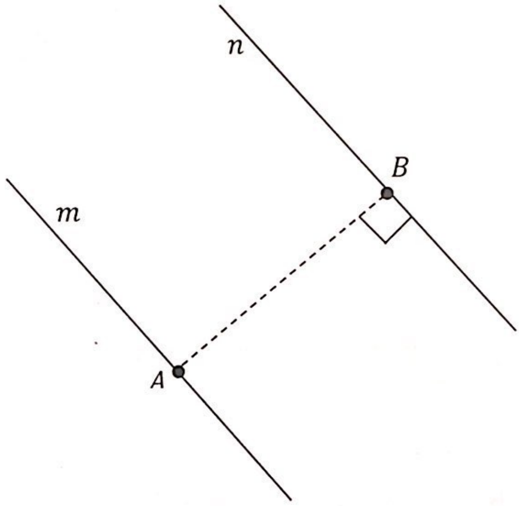
The line $m: 2x + 3y + 1 = 0$ is parallel to the line $n: 2x + 3y - 51 = 0$.

(a) Verify that $A(-2, 1)$ is on m.

$2(-2) + 3(1) + 1$

$= -4 + 3 + 1 = 0$ $\therefore$ A on m

(b) Find the coordinates of B, the point on the line n closest to A, as shown below.



line $AB \perp m$

$\therefore$ eqn AB =

$3x - 2y + k = 0$

$(-2, 1) \Rightarrow 3(-2) - 2(1) + k = 0$

$k = 8$

$\therefore 3x - 2y + 8 = 0$

$n \Rightarrow 2x + 3y - 51 = 0$

$9x - 6y + 24 = 0$

$4x + 6y - 102 = 0$

$13x - 78 = 0$

$x = 6$

$y = \frac{-8 - 3(6)}{-2} = 13$

$\boxed{(6, 13)}$

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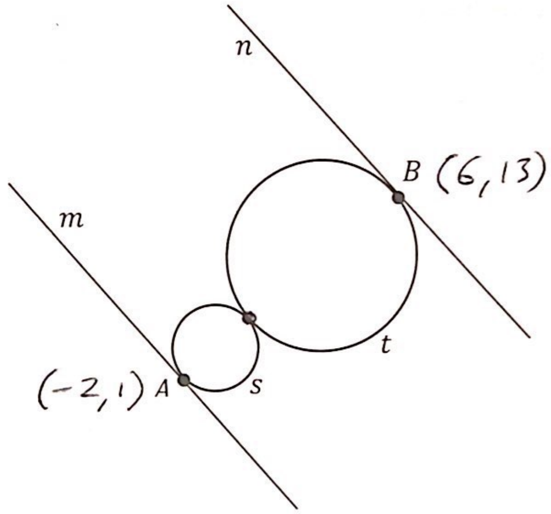
(c) Two touching circles, s and t, are shown in the diagram. m is a tangent to s at A and n is a tangent to t at B. The ratio of the radius of s to the radius of t is $1 : 3$.
Find the equation of s.



To find centre of s

Divide AB in ratio 1 : 7

$$\left(\frac{1(6)+7(-2)}{1+7}, \frac{1(13)+7(1)}{1+7}\right)$$

$$= \left(\frac{-8}{8}, \frac{20}{8}\right)$$

$$= (-1, 2.5)$$

$$\text{Radius} = \sqrt{(-2+1)^2 + (1-2.5)^2} = \sqrt{3.25}$$

Eqn s : $\boxed{(x+1)^2 + (y-2.5)^2 = 3.25}$

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