



















- 5 The curve  $C$  has polar equation  $r = a \sec^2 \theta$ , where  $a$  is a positive constant and  $0 \leq \theta \leq \frac{1}{4}\pi$ .
- (a) Sketch  $C$ , stating the polar coordinates of the point of intersection of  $C$  with the initial line and also with the half-line  $\theta = \frac{1}{4}\pi$ . [3]

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- (b) Find the maximum distance of a point of  $C$  from the initial line. [2]

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- (c) Find the area of the region enclosed by  $C$ , the initial line and the half-line  $\theta = \frac{1}{4}\pi$ . [4]

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**(d)** Find, in the form  $y = f(x)$ , the Cartesian equation of  $C$ . [3]

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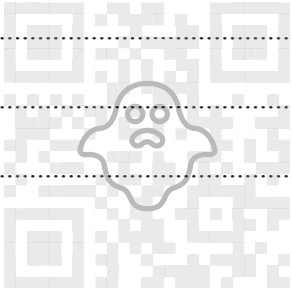
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The plane  $\Pi_1$  contains  $PQ$  and  $l_1$ .

The plane  $\Pi_2$  contains  $PQ$  and  $l_2$ .

(b) (i) Write down an equation of  $\Pi_1$ , giving your answer in the form  $\mathbf{r} = \mathbf{a} + s\mathbf{b} + t\mathbf{c}$ . [1]

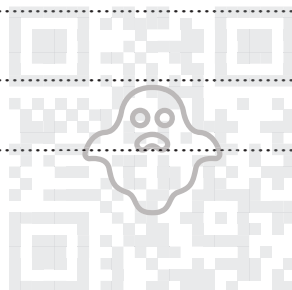
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(ii) Find an equation of  $\Pi_2$ , giving your answer in the form  $ax + by + cz = d$ . [4]

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(c) Find the acute angle between  $\Pi_1$  and  $\Pi_2$ . [5]

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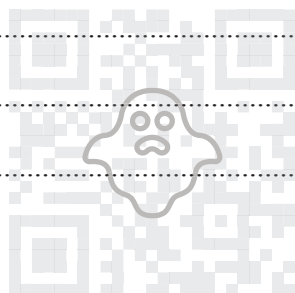
7 The curve  $C$  has equation  $y = \frac{x^2 - x}{x + 1}$ .

(a) Find the equations of the asymptotes of  $C$ . [3]

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(b) Find the exact coordinates of the stationary points on  $C$ . [4]

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(c) Sketch  $C$ , stating the coordinates of any intersections with the axes.

[3]

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(d) Sketch the curve with equation  $y = \left| \frac{x^2 - x}{x + 1} \right|$  and find in exact form the set of values of  $x$  for which  $\left| \frac{x^2 - x}{x + 1} \right| < 6$ .

[5]



Dotted lines for writing.

