## **Question 7**

A plane is flying horizontally at P at a height of 150 m above level ground when it begins its descent. P is 5 km, horizontally, from the point of touchdown O. The plane lands horizontally at O.



Taking *O* as the origin, (x, f(x)) approximately describes the path of the plane's descent where  $f(x) = 0.0024x^3 + 0.018x^2 + cx + d$ ,  $-5 \le x \le 0$ , and both *x* and f(x) are measured in km.

(a) (i) Show that d = 0.



(ii) Using the fact that P is the point (-5, 0.15), or otherwise, show that c = 0.



(b) (i) Find the value of f'(x), the derivative of f(x), when x = -4.

(ii) Use your answer to part (b) (i) above to find the angle at which the plane is descending when it is 4 km from touchdown. Give your answer correct to the nearest degree.



Show that (-2.5, 0.075) is the point of inflection of the curve y = f(x). (c)



If (x, y) is a point on the curve y = f(x), verify that (-x-5, -y+0.15) is also a point (d) (i) on y = f(x).



Find the image of (-x-5, -y+0.15) under symmetry in the point of inflection. (ii)

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