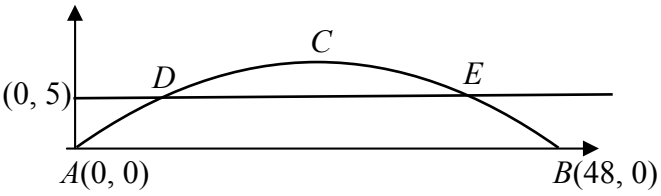
Question 8 **(50 marks)**

In 2011, a new footbridge was opened at Mizen Head, the most south-westerly point of Ireland.

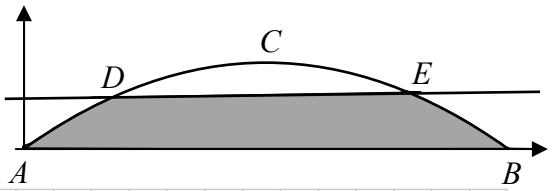
The arch of the bridge is in the shape of a parabola, as shown. The length of the span of the arch, $[AB]$, is 48 metres.



(a) Using the co-ordinate plane, with $A(0, 0)$ and $B(48, 0)$, the equation of the parabola is $y = -0 \cdot 013x^2 + 0 \cdot 624x$. Find the co-ordinates of C, the highest point of the arch.

(b) The perpendicular distance between the walking deck, $[DE]$, and $[AB]$ is 5 metres. Find the co-ordinates of D and of E. Give your answers correct to the nearest whole number.

(c) Using integration, find the area of the shaded region, *ABED,* shown in the diagram below. Give your answer correct to the nearest whole number.



(d) Write the equation of the parabola in part **(a)** in the form $y-k=p(x-h)^2$, where k, p, and h are constants.

(e) Using what you learned in part **(d)** above, or otherwise, write down the equation of a parabola for which the coefficient of x^2 is -2 and the co-ordinates of the maximum point are $(3,-4)$.