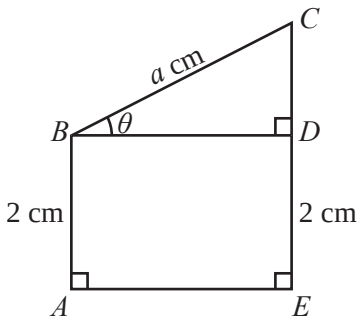
Question 10

The figure shown represents a wire frame where $ABCE$ is a convex quadrilateral. The point D is on line segment EC with $AB = ED = 2$ cm and $BC = a$ cm, where a is a positive constant.

$$\angle BAE = \angle CEA = \frac{\pi}{2}$$

Let $\angle CBD = \theta$ where $0 < \theta < \frac{\pi}{2}$.



a. Find BD and CD in terms of a and θ.

2 marks

b. Find the length, L cm, of the wire in the frame, including length BD, in terms of a and θ.

1 mark

c. Find $\frac{dL}{d\theta}$, and **hence** show that $\frac{dL}{d\theta} = 0$ when $BD = 2CD$.

2 marks

d. Find the maximum value of L if $a = 3\sqrt{5}$.

1 mark

END OF QUESTION AND ANSWER BOOK

Question 10

Let $f: R \rightarrow R,\ f(x) = e^{-mx} + 3x$, where m is a positive rational number.

a. **i.** Find, in terms of m, the x-coordinate of the stationary point of the graph of $y = f(x)$.

ii. State the values of m such that the x-coordinate of this stationary point is a positive number.

2 + 1 = 3 marks

b. For a particular value of m, the tangent to the graph of $y = f(x)$ at $x = -6$ passes through the origin. Find this value of m.

3 marks

END OF QUESTION AND ANSWER BOOK