Question 8 (6 marks)

A small helium balloon is released and rises vertically so that its height metres above its launch site after seconds is given by . A video camera is located metres horizontally from the launch site of the balloon and automatically rotates so that it is always pointing directly at the balloon.

Determine the rate at which the camera is rotating seconds after the balloon is released.

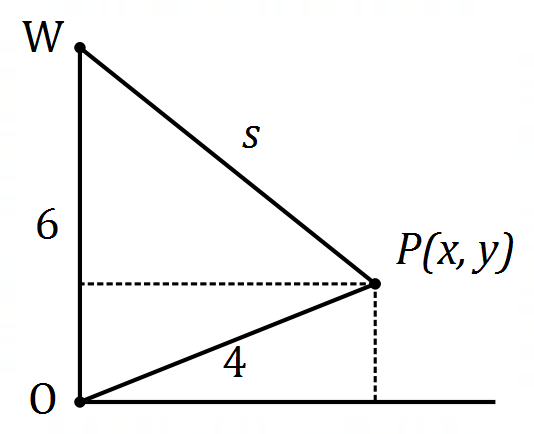
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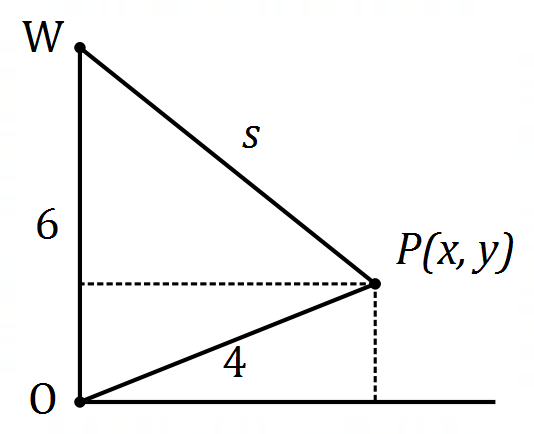
|  |
| --- |
| Solution |
| Since then given rate is .  Required rate is and the relation between variables is .  When and so and then . (NB . Hence:  The camera is rotating at radians per second. |
| Specific behaviours |
| ✓ differentiates to obtain given rate  ü obtains formula for in terms of  ü obtains formula for required rate in terms of and  ü obtains value for (or ) at required time  ü substitutes values into required rate formula  ü states correct rate, with units. |

Question 19 (7 marks)

A light rope from winch , at the top of a  
six-metre-tall wall , is attached to  
point at the end of a four-metre-long pole .  
  
The winch is winding the rope in at a rate of cm/s  
so that the pole is rotating about from a horizontal  
to a vertical position.  
  
Let be the length of the rope , and let be the  
horizontal distance and be the vertical distance  
of relative to .

Show that and hence determine the rate at which is decreasing at the instant that is increasing at a rate of cm/s.

Question 19 (7 marks)

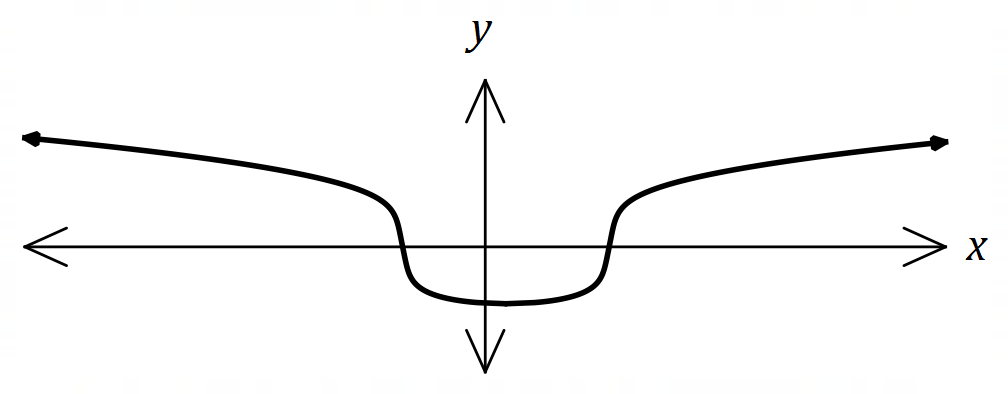
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Show that and hence determine the rate at which is decreasing at the instant that is increasing at a rate of cm/s.

|  |
| --- |
| **Solution** |
| Using right triangle with as hypotenuse:  Given: and . Required to find .  Using length of pole:  Using :  When and  Hence is decreasing at a rate of cm/s. |
| **Specific behaviours** |
|  derives expression for in terms of  ✓ uses length of pole to relate and   implicitly differentiates to relate and   implicitly differentiates to relate and   solves for   solves for and   states required rate with units |

Question 11 (6 marks)

A particle is moving along the curve shown below with equation .

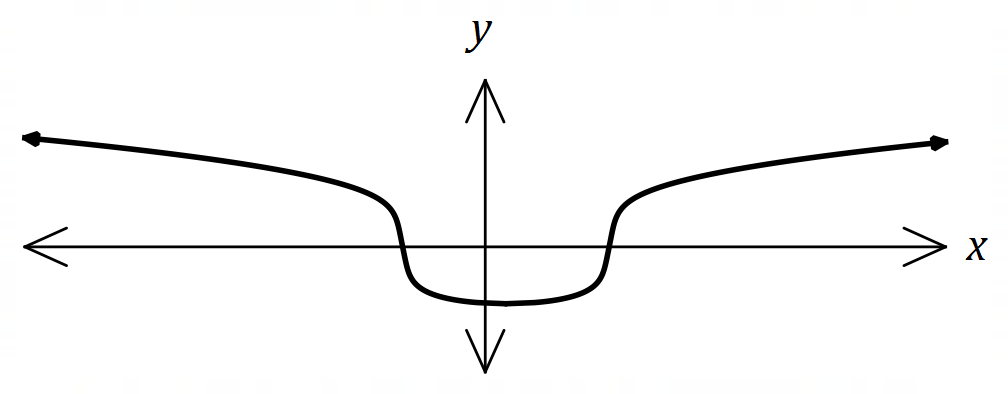


The -coordinate of the particle is changing at a constant rate given by .

Determine the rates at which the -coordinate of the particle is changing when .

Question 11 (6 marks)

A particle is moving along the curve shown below with equation .



The -coordinate of the particle is changing at a constant rate given by .

Determine the rates at which the -coordinate of the particle is changing when .

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
|  implicitly differentiates wrt   expression for   expression for   determines when   one correct rate   both correct rates |

|  |
| --- |
| **Alternative part solution** |
|  |
| **Specific behaviours** |
| ✓ implicitly differentiates LHS wrt   implicitly differentiates RHS wrt   expression for |