

Geraldton Senior High School

**ATMAM Math Methods**

Test 1: Chapters 1 to 5

**20 minutes Section 1 - Calculator Free 20 marks**

1. **[6 marks]**

A body moves under rectilinear motion such that for time seconds, , the body’s displacement, metres, from the origin O is given by

* 1. Determine its acceleration at . (2 mark)
  2. Use calculus techniques and the second derivative to determine and justify when the displacement is at a maximum.  
      (4 marks)

1. **[5 marks]**  
   For the following questions, **do not simplify your answers.**  
   1. Determine

(3 marks)

* 1. Determine given that  
      (2 marks)

1. **[5 marks]**

Determine

* 1. (2 marks)

* 1. (3 mark)

1. **[4 marks]**

Consider the functions given by and .

Determine:

* 1. (1 mark)
  2. (1 mark)

And hence,

* 1. Use parts a) and b) to determine in its simplest form. (2 marks)

NAME: TEACHER:

Geraldton Senior High School

**ATMAM Math Methods**

Test 1: Chapters 1 to 5

**35 minutes Section 2 - Calculator Assumed 35 marks**

1. **[4 marks]**

A sphere of radius 30 cm is sitting on the base of a container of water. The water level is rising at a rate of 2 cm per second, so that the sphere is gradually becoming submerged.

Let h be the height of the water as illustrated below left. The submerged portion of the sphere is as shown below right.

Diagram, venn diagram

Description automatically generated A picture containing diagram

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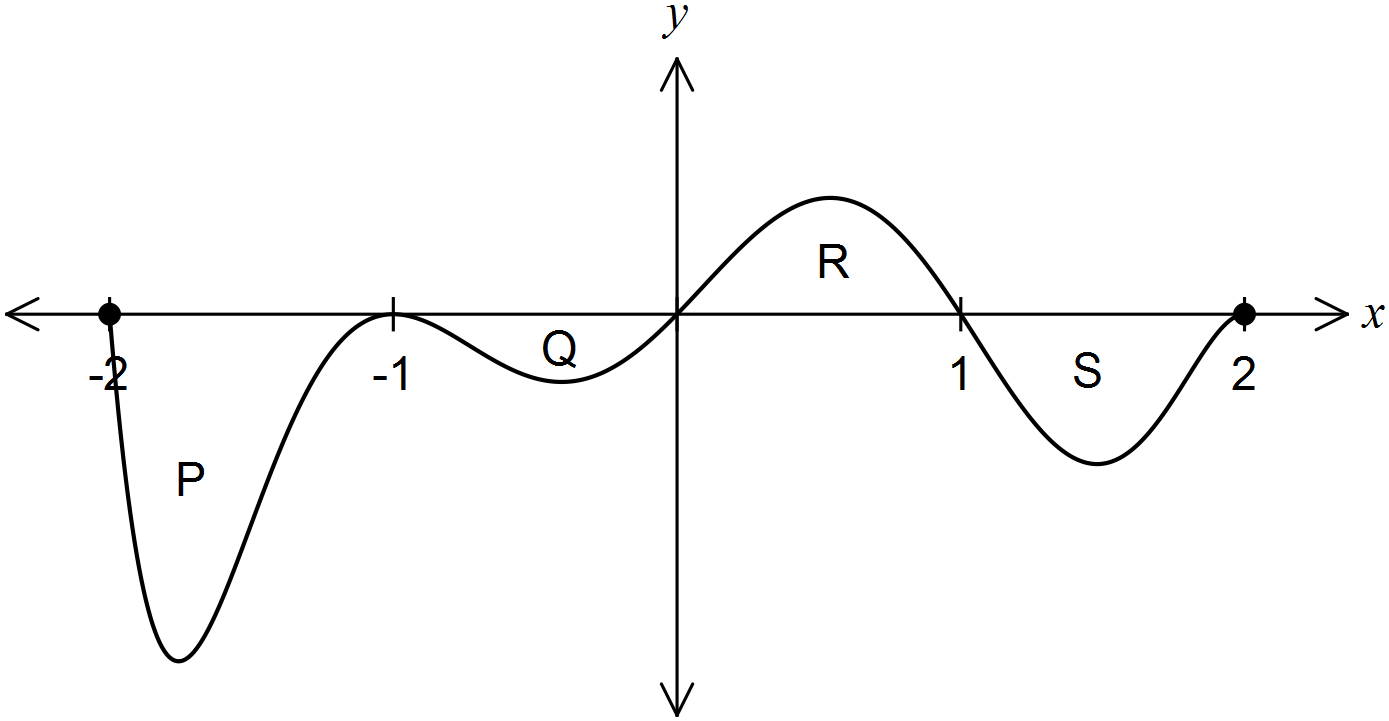
The volume of the submerged portion, where is the radius of the sphere is given by

Using the small change formula: or equivalently

Calculate to 1d.p. the approximate increase in submerged volume for a increase in height when

1. **[6 marks]**

The graph of the function is shown below over the domain .



The areas of regions P, Q, R and S enclosed by the curve and the are 5, 1, 2 and 3 square units respectively.

* 1. Determine the area enclosed by the curve and the for . (1 mark)
  2. Determine the value of

1. (1 marks)
2. (2 marks)
3. (2 marks)
4. **[7 marks]**



A cylinder of radius metres and height metres is to be constructed inside a cone of height and base radius as shown.

*r*

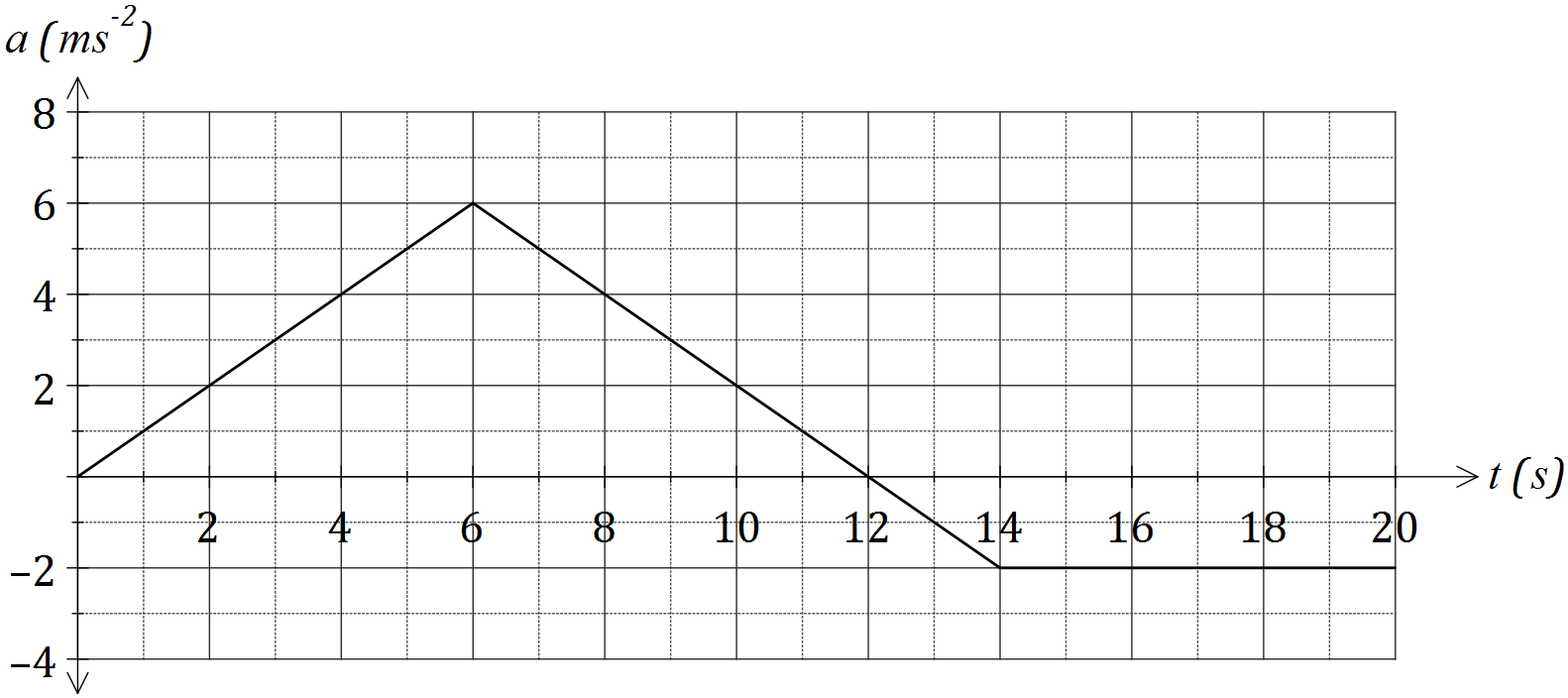
* 1. Show clearly why . (1 mark)

*h*

* 1. Show clearly why the volume of the cylinder is given as: (2 marks)
  2. Use Calculus to determine the dimensions (i.e. height & radius) of such a cylinder which gives maximum volume. (4 marks)

1. **[8 marks]**

A particle, initially stationary and at the origin, moves subject to an acceleration, ms-2, as shown in the graph below for seconds.



a) Determine the velocity of the object when

1. . (1 mark)
2. . (2 marks)

b) At what time is the velocity of the body a maximum, and what is the maximum velocity? (2 marks)

c) Determine the distance of the particle from the origin after seconds. (3 marks)

1. **[5 marks]**

Leveraging your calculator use the calculus tools of *the* first and second derivative to determine the location and nature of all the stationary points of

1. **[5 marks]**

Shown are the graphs of



*a*

*b*

* 1. Write an appropriate calculation using three integrals that can be used to determine the area bound by the two curves and . Do not evaluate. (3 marks)
  2. Calculate the area bound between the curves and by writing and evaluating a single integral over the bounds, . (2 marks)