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**MATHEMATICS**

**Specialist Units 3 & 4**

**Test 4 – Antidifferentiation and Definite Integrals**

**Semester 2 2019**

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**Section Two – Calculator Assumed**

Time allowed for this section

Working time for this section: 31 minutes

Marks available: 31 marks

## Material required/recommended for this section

##### To be provided by the supervisor

This Question/Answer booklet

Formula sheet

##### To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

Special items: drawing instruments, templates, notes on one unfolded sheet of A4 paper, and up to three calculators satisfying the conditions set by the Curriculum Council for this course.

## Important note to candidates

No other items may be used in this section of the examination. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

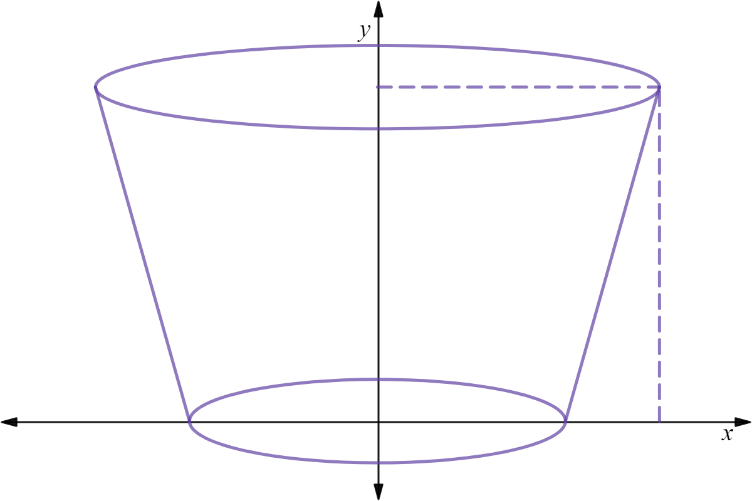
1. (8 marks: 3, 5)  
   The graph of the curve of equation is shown below. The line of equation is tangent to the curve at point P. The shaded region is enclosed by the curve, the tangent line and the axis.

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P

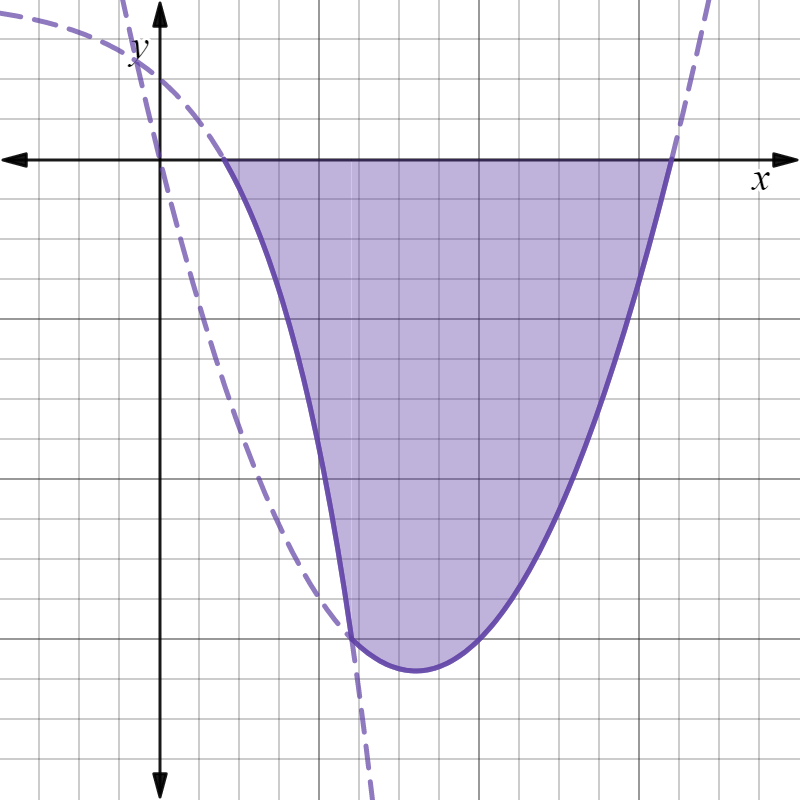
1. Find the co-ordinates of point P and the intercepts of the curve and the tangent line.
2. Find an integral expressionfor the area of this region in terms of
3. horizontal elementary slices (i.e. with respect to y)
4. vertical elementary slices (i.e. with respect to x)

1. (8 marks: 4, 4)   
   For the curves with equations and determine the volume of the solid formed when the region enclosed by the two curves is
2. rotated about the
3. rotated about the axis
4. (5 marks)   
   A bucket has a circular base of radius cm and a circular rim of radius cm. The perpendicular height of the bucket is cm. Use calculus techniques to determine, in simplest form, the volume of water, in terms of this bucket will hold when full.

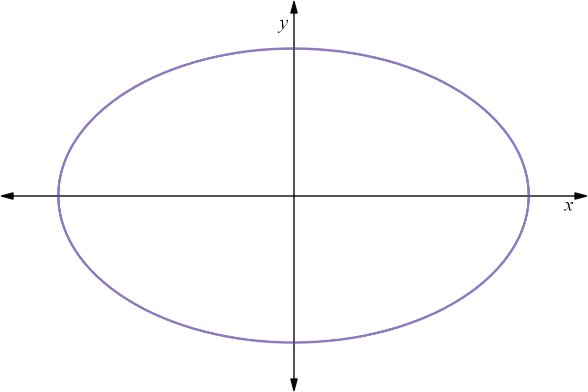
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1. (5 marks)   
   Below is shown the uniform cross-section of a drainage canal (shaded), the bed of which is described by curves; and , where and are measured in metres and the axis represents the water level. If the water is flowing at the rate of then how many kilolitres (to the nearest kL) of water will pass by in two minutes.

Note: 1 m3 = 1kL

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1. (5 marks: 3, 2)  
   The ellipse shown has equation with .

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Use a suitable integral to determine, in terms of ,

1. the area of the ellipse.
2. the volume of the ellipsoid formed by rotation of the ellipse about the axis.

**End of Test**

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You may use this space to extend or re-attempt an answer to a question or questions and should you do so then number the question(s) attempted and cross out any previous unwanted working.

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