# W04 - Homework

## Stepwise problems - Thu. 11:59pm

### Arc length

#### 01

**Arc length - reversed $x$ and $y$ roles**

Find the arc length of the curve that satisfies the equation $x = \frac{1}{12}y^3 + y^{-1}$ over $y \in [1, 2]$.

### Surface areas of revolutions - thin bands

#### 02

**Surface area: revolved cubic**

The curve $y = x^3$ over $x \in [0, 2]$ is revolved around the $x$-axis.

Find the area of the resulting surface.

## Regular problems - Sat. 11:59pm

### Arc length

#### 03

**Arc length - tricky algebra**

Find the arc length of the curve $y = \frac{x^4}{8} + \frac{1}{4x^2}$ for $x \in [1, 2]$.

(Hint: expand under the root, then simplify, then factor; now it's a square and the root disappears.)

#### 04

**Arc length - tricky integration**

Find the arc length of the curve $y = e^x$ for $x \in [0, 1/2]$.

(Hint: the integral can be done using either: (i) $u$-sub then trig sub, or (ii) 'rationalization' then partial fractions.)

### Surface areas of revolutions - thin bands

#### 05

**Surface area: cone**

A *cone* may be described as the surface of revolution of a ray emanating from the origin, revolved around the $x$-axis.

Let $f(x) = mx$ for some $m > 0$. Find the surface area of the cone given by revolving the graph of $f$ over $x \in [0, h]$.

Can you also calculate this area using geometry? And verify the two methods give the same formula? (Hint: 'unroll' the cone into a sector.)

## 06

### Surface area: parabolic reflector

A parabolic reflector is given by rotating the curve $y = x^2$ around the *y-axis* for $x \in [0, 2]$.

What is the surface area of this reflector?

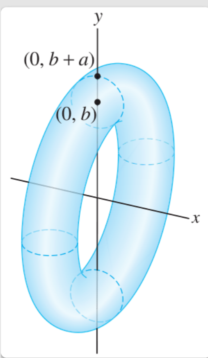
## 07

### Surface area: torus

A torus is created by revolving about the *x-axis* the circle with this equation:

$$x^2 + (y - b)^2 = a^2$$

Find the surface area of this torus.




(Hint: compute for the top and bottom of the circle separately and add the results.)