Math 174
Calculus II

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Lesson 19
Hydrostatic Force

Initializations

```
> restart;
  with(plots):
```

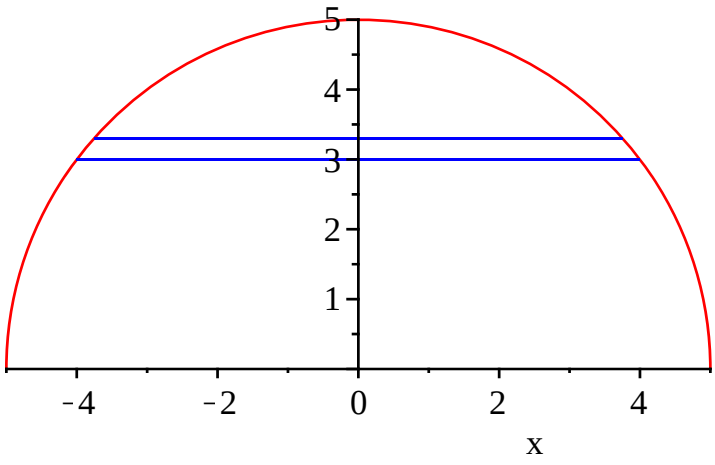
19.1 Hydrostatic Force

Examples

Example 19.1.1

A vertical dam has a gate in the shape of a semi-circle. The radius of the gate is 5 ft and the base of the gate is 100 ft below the water level. Find the total force exerted by the water on the dam.

Solution
With pencil and paper, sketch the gate and a horizontal slice of that gate.



If the slice is centered around the points with a y-coordinate y, the the force on the slice is equal to

$$(water\ density)\cdot(depth)\cdot(area)$$

Density of water is approximately 62.5 Lb/ft^3. So we obtain

$$dF = 62.5(100 - y)\left(2\sqrt{25 - y^2}\right)dy$$

In order to avoid the display of long decimal approximations we will code 62.5 as $\frac{125}{2}$.

```
> F:=Int(125/2*(100-y)*2*sqrt(25-y^2), y=0..5);
```

$$F := \int_0^5 125\,(100 - y)\sqrt{25 - y^2}\,dy \qquad \textbf{(2.1.1.1)}$$

The total hydrostatic force on the gate is given by

```
> F:=value(F);
  evalf(F);
```

$$F := 78125\,\pi - \frac{15625}{3}$$

$$2.402285928\ 10^5 \qquad \textbf{(2.1.1.2)}$$

```
>
```