

## 19.8: Contracted and Extended Cycloids

As in Section 19.1, we consider a circle of radius  $a$  rolling to the right on the line  $y = 2a$ . The point P is initially below the centre of the circle, but, instead of being on the rim of the circle, its distance from the centre of the circle is  $r$ . If  $r < a$ , the path described by P will be a **contracted cycloid**; if  $r > a$ , the path is an **extended cycloid**. (I think there's a case for using this nomenclature the other way round, but most authors seem to use "contracted" for  $r < a$  and "extended" for  $r > a$ .) It should not take long to be convinced, by arguments similar to those in Section 19.1, that the parametric equations to a contracted or extended cycloid are

$$x = 2a\theta + r \sin 2\theta \quad (19.8.1)$$

and

$$y = a - r \cos 2\theta \quad (19.8.2)$$

These are illustrated in Figures XIX.8 and XIX.9 for a contracted cycloid with  $r = 0.5a$  and an extended cycloid with  $r = 1.5a$ .

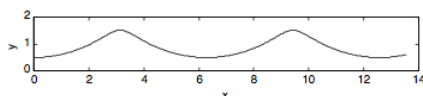


FIGURE XIX.8

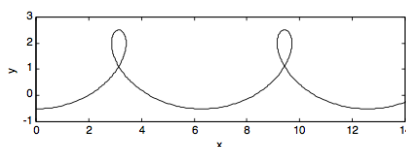


FIGURE XIX.9

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