# Section3.3

Derivatives of trigonometric functions

1. $f(x) = 1 - 3\sin x$
   $\Rightarrow f'(x) = (1)' - 3(\sin x)' = -3\cos x$

2. $f(x) = x\sin x$
   $\Rightarrow f'(x) = (x)'\sin x + x(\sin x)' = \sin x + x\cos x$

9. $y = \frac{x}{2-\tan x}$
   $\Rightarrow \frac{dy}{dx} = \frac{(2-\tan x)(x)' - x(2-\tan x)'}{(2-\tan x)^2} = \frac{(2-\tan x)(1) - x(-\sec^2 x)}{(2-\tan x)^2} = \frac{2-\tan x + x\sec^2 x}{(2-\tan x)^2}$

22. $y = e^x\cos x, \quad (0,1)$
    $\frac{dy}{dx} = e^x\cos x + e^x(-\sin x) = e^x\cos x - e^x\sin x$
    $\frac{dy}{dx}|_{x=0} = e^0\cos 0 - e^0\sin 0 = 1 - 0 = 1$
    The slope of the tangent line at $(0,1)$ is 1. So, the equation of the tangent line at $(0,1)$ is $y - 1 = 1(x-0)$ or $y = x+1$.

35. (a). $x(t) = 8\sin t$
    The equation of velocity $v(t) = x'(t) = 8\cos t$.
    The equation of acceleration $a(t) = x''(t) = -8\sin t$.

    (b). The mass at time $t = \frac{2\pi}{3}$ has position $x(\frac{2\pi}{3}) = 8\sin(\frac{2\pi}{3}) = 8(\frac{\sqrt{3}}{2}) = 4\sqrt{3}$, velocity $v(\frac{2\pi}{3}) = 8\cos(\frac{2\pi}{3}) = 8(\frac{-1}{2}) = -4$, and acceleration $a(\frac{2\pi}{3}) = -8\sin(\frac{2\pi}{3}) = -8(\frac{\sqrt{3}}{2}) = -4\sqrt{3}$. Since $v(\frac{2\pi}{3}) < 0$, the particle is moving to the left.

37. From the figure 1: 3-3-12, we can see that $\sin\theta = x/6 \Leftrightarrow x = 6\sin\theta$. We want to find the rate of change of $x$ with respect to $\theta$, that is $\frac{dx}{d\theta}$. Taking the derivative of $x = 6\sin\theta$, we get $\frac{dx}{d\theta} = 6\cos\theta$. So, when $\theta = \frac{\pi}{3}$, $\frac{dx}{d\theta} = 6\cos(\frac{\pi}{3}) = 6(\frac{1}{2}) = 3\ m/rd$

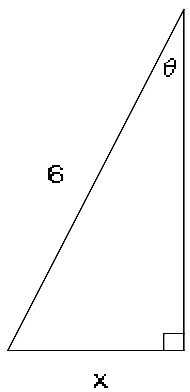


Figure 1: 3-3-12