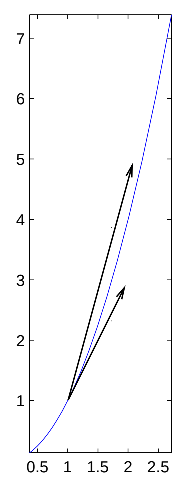
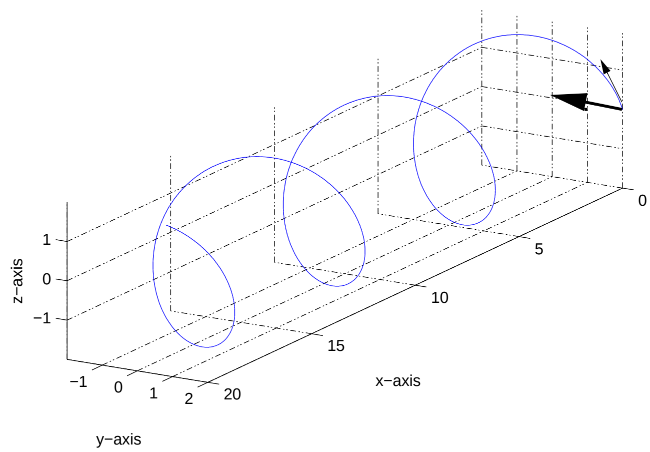
Answers to Even Exercises, Homework Set 11

Section 10.3 #30 curve a is $\kappa(x)$, and curve b is $f(x)$, so the red curve is the curvature of the blue one.

Section 10.4 #6 $\vec{v}(t) =< e^t, 2e^{2t} >$ and $\vec{a}(t) =< e^t, 4e^{2t} >$, so $\vec{v}(0) =< 1, 2 >$ and $\vec{a}(0) =< 1, 4 >$



#8 $\vec{v}(t) =< 1, -2\sin(t), \cos(t) >$ and $\vec{a}(t) =< 0, -2\cos(t), -\sin(t) >$, so $\vec{v}(0) =< 1, 0, 1 >$ and $\vec{a}(0) =< 0, -2, 0 >$. (Notice in this case that $\vec{a}(0) \perp \vec{v}(0)$)



#14 $\vec{v}(t) = (2t+1)\vec{i}+3t^2\vec{j}+4t^3\vec{k}$ and $\vec{r}(t) = (t^2+t)\vec{i}+(t^3+1)\vec{j}+(t^4-1)\vec{k}$

#20 If $|\vec{r}'(t)| = C$ for all t, then writing it out in components, we get:

$$\sqrt{(x'(t))^2 + (y'(t))^2 + (z'(t))^2} = C$$

which implies that

$$(x'(t))^2 + (y'(t))^2 + (z'(t))^2 = C\ .$$

Taking the derivative of both sides, we get:

$$2x'x'' + 2y'y'' + 2z'z'' = 0$$

which is the same as

$$2\vec{v} \cdot \vec{a} = 0$$

Thus the velocity and acceleration are always perpindicular to one another.

Section 10.5# 12 V

14 III

16 VI