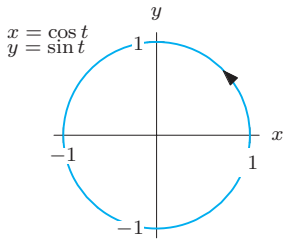
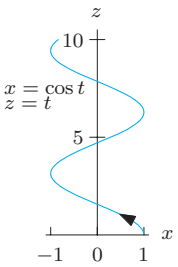
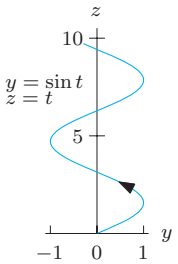






73 (a) $x = 2 + at, y = 1 + bt, z = 3 + ct$
(b) $a/2 = b/1 = c/3$

75 α is radius of cylinder
β determines vertical distance moved

77 (a) (vii)
(b) (ii)
(c) (iv)

79 $\vec{r} = 9.65\vec{k} + t(325\vec{i} + 563\vec{j} - 0.84\vec{k})$

81 (a) Parallel
(b) (i) Perpendicular
(ii) Parallel

83 Different parameterization of same curve

85 $x = \cos t, y = \sin t, z = 0$
$x = 0, y = \cos t, z = \sin t$

87 $x = t^3, y = 2t^3, z = 3 + 4t^3$

89 True

91 True

93 True

95 True

97 False

99 False

Section 17.2

1 $\vec{v} = 3\vec{i} + \vec{j} - \vec{k}, \quad \vec{a} = \vec{0}$

3 $\vec{v} = \vec{i} + 2t\vec{j} + 3t^2\vec{k}, \quad \vec{a} = 2\vec{j} + 6t\vec{k}$

5 $\vec{v} = -3\sin t\vec{i} + 4\cos t\vec{j},$
$\vec{a} = -3\cos t\vec{i} - 4\sin t\vec{j}$

7 $\vec{v} = \vec{i} + 2t\vec{j} + 3t^2\vec{k},$
Speed $= \sqrt{1 + 4t^2 + 9t^4},$
Particle never stops

9 $\vec{v} = 6t\vec{i} + 3t^2\vec{j},$
$\|\vec{v}\| = 3|t| \cdot \sqrt{4 + t^2},$
Stops when $t = 0$

11 $\vec{v} = 6t\cos(t^2)\vec{i} - 6t\sin(t^2)\vec{j},$
$\|\vec{v}\| = 6|t|,$
Stops when $t = 0$

13 Length $= \sqrt{42}$

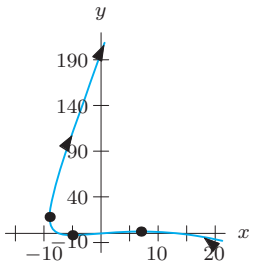
15 Length $= e - 1$

17 $\vec{v} = -6\pi\sin(2\pi t)\vec{i} + 6\pi\cos(2\pi t)\vec{j},$
$\vec{a} = -12\pi^2\cos(2\pi t)\vec{i} - 12\pi^2\sin(2\pi t)\vec{j},$
$\vec{v} \cdot \vec{a} = 0, \|\vec{v}\| = 6\pi, \|\vec{a}\| = 12\pi^2$

19 Line through $(2, 3, 5)$ in direction of
$\vec{i} - 2\vec{j} - \vec{k},$
$\vec{v} = 2t(\vec{i} - 2\vec{j} - \vec{k}), \vec{a} = 2(\vec{i} - 2\vec{j} - \vec{k})$

21 $x = 1 + 2(t - 2), y = 2, z = 4 + 12(t - 2)$

23 Vertical: $t = 3$
Horizontal: $t = \pm 1$
As $t \to \infty, x \to \infty, y \to \infty$
As $t \to -\infty, x \to \infty, y \to -\infty$



25 (a) $\vec{v}(2) \approx -4\vec{i} + 5\vec{j},$
Speed $\approx \sqrt{41}$
(b) About $t = 1.5$
(c) About $t = 3$

27 (a) $x = 2 + 0.6t, y = -1 + 0.8t, z = 5 - 1.2t, 0 \le t \le 5$
(b) $x = 2 + 1.92t, y = -1 + 2.56t, z = 5 - 3.84t, 0 \le t \le 1.56$

29 (a) 6.4 meters
(b) 1.14 sec
(c) 15.81 m/sec
(d) $(11.4, -5.7, 0)$
(e) -9.8 m/sec^2

31 (a) 5 secs; $(10, 15, 100)$
(b) $t = 0$, 10 secs, $\sqrt{113}$ cm/sec
(c) 5 secs, $\sqrt{13}$ cm/sec

33 (a) $t = 5.181$ sec
(b) $x = 103.616$ meters
(c) 2 meters
(d) 9.8 meters/sec^2
(e) $\theta = 0.896$; $v = 32.016$ meters/sec

35 (a) (IV); 4.5 sec; (0, 8.9 m, 0)
(b) (II); 3.2 sec; base of tower
(c) (V); 10 sec; halfway up

37 $\vec{r}(t) = 22.1t\vec{i} + 66.4t\vec{j}$
$+ (442.7t - 4.9t^2)\vec{k}$

41 (a) No
(b) $t = 5$
(c) $\vec{v}(5) \approx 0.959\vec{i} + 0.284\vec{j} + 2\vec{k}$
(d) $\vec{r} \approx 0.284\vec{i} - 0.959\vec{j} + 10\vec{k}$
$+ (t - 5)(0.959\vec{i} + 0.284\vec{j} + 2\vec{k})$.

43 (a) $\vec{r}(t) = t\cos(2\pi t)\vec{i} + t\sin(2\pi t)\vec{j},$
$0 \le t \le 100$
(b) $\vec{v} = \vec{r}\,'(t) =$
$(\cos(2\pi t) - 2\pi t\sin(2\pi t))\vec{i} +$
$(\sin(2\pi t) + 2\pi t\cos(2\pi t))\vec{j}$
$\|\vec{v}\| = (1 + 4\pi^2 t^2)^{1/2}$ cm/sec
(c) $\vec{a} = \vec{v}\,'(t) =$
$(-4\pi\sin(2\pi t) - 4\pi^2 t\cos(2\pi t))\vec{i} +$
$(4\pi\cos(2\pi t) - 4\pi^2 t\sin(2\pi t))\vec{j}$
$\|\vec{a}\| = 4\pi(1 + \pi^2 t^2)^{1/2}$ cm/sec^2

45 (a) $x \approx 694.444t$
$+ 20\cos(2\pi t)$cm
$y = 30 + 20\sin(2\pi t)$ cm
(c) At least 5.526 revs/sec

47 No

49 (a) $2\vec{r} \cdot d\vec{r}/dt$
(b) $\vec{a} \times d\vec{r}/dt$
(c) $r^3 d\vec{r}/dt + 3r^2\vec{r}$

55 Acceleration is a vector, not a scalar

57 $\vec{r}(t) = \left(t + 2t^2\right)\vec{i} + 2t\vec{j} + 3t^2\vec{k}$

59 False

61 False

63 False

65 False

67 True

69 False

Section 17.3

1 $\vec{V} = x\vec{i}$

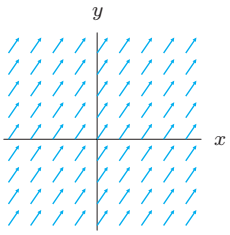
3 $\vec{V} = x\vec{i} + y\vec{j} = \vec{r}$

5 $\vec{V} = -x\vec{i} - y\vec{j} = -\vec{r}$

7 (a) y-axis
(b) Increasing
(c) Neither

9 (a) x-axis
(b) Increases
(c) Decreases

11



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