1. Section 1-1

Find the vector with initial point P_1 and final point P_2. Sketch the result in either the xy-plane or in R^3, whichever is appropriate.

1. $\overrightarrow{P_1P_2} = \langle 1, 2\rangle$
3. $\overrightarrow{P_1P_2} = \langle -4, -2, -2\rangle$
5. $\overrightarrow{P_1P_2} = \langle 1, 10, 4\rangle$
7. $\overrightarrow{P_1P_2} = \langle -7, 20, 4\rangle$
9. $\overrightarrow{P_1P_2} = \langle 1, 2, 3\rangle$
11. $\mathbf{u} + \mathbf{v} = \langle 3, 8\rangle$
13. $\mathbf{u} + \mathbf{v} = \langle -2, 3\rangle$
15. $\mathbf{u} + \mathbf{v} = \langle 1, 1, 0\rangle$
17. $\mathbf{u} + \mathbf{v} = \langle 2, 4, 5\rangle$

19.	$\mathbf{L}(t) = \langle t, 5t + 7\rangle$	$\mathbf{K}(s) = \langle s + 1, 5s + 2\rangle$
21.	$\mathbf{L}(t) = \langle t + 2, 2t + 3\rangle$	$\mathbf{K}(s) = \langle s + 3, 2s + 5\rangle$
23.	$\mathbf{L}(t) = \langle -4t + 7, -2t + 9, -2t + 2\rangle$	$\mathbf{K}(s) = \langle -4s + 3, -2s + 7, -2s\rangle$
25.	$\mathbf{L}(t) = \langle t - 4, 20t - 17, 4t + 1\rangle$	$\mathbf{K}(s) = \langle s - 3, 20s + 3, 4s + 5\rangle$
27.	$\mathbf{L}(t) = \langle -te + \pi, t\pi + e, -2t + 2\rangle$	$\mathbf{K}(s) = \langle -se + \pi - e, s\pi + \pi + e, -2s\rangle$

2. Section 1-2

1. $\|\mathbf{u}\| = 5, \|\mathbf{v}\| = 2, \theta = 36.869°$
3. $\|\mathbf{u}\| = 5.009, \|\mathbf{v}\| = 9.214, \theta = 23.839°$
5. $\|\mathbf{u}\| = 10, \|\mathbf{v}\| = 10, \theta = 90°$
7. $\|\mathbf{u}\| = 3, \|\mathbf{v}\| = 6.324, \theta = 42.45°$
9. $\|\mathbf{u}\| = 1, \|\mathbf{v}\| = 1, \theta = 90°$
11. $k = -12$
13. $k = 2$
15. *no solution*
17. $k = 1.104$
19. $k = -1$ *or* $k = -6$

21.	$\mathbf{p} = \langle 1, 7\rangle,\ \mathbf{v} = \langle 2, 11\rangle$	$proj_{\mathbf{p}}(\mathbf{v}) = \langle 1.58, 11.06\rangle$
23.	$\mathbf{p} = \langle 1, 2, 1\rangle,\ \mathbf{v} = \langle 2, 2, 7\rangle$	$proj_{\mathbf{p}}(\mathbf{v}) = \langle \frac{13}{6}, \frac{13}{3}, \frac{13}{6}\rangle$
25.	$\mathbf{p} = \mathbf{j},\ \mathbf{v} = 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$	$proj_{\mathbf{p}}(\mathbf{v}) = -3\mathbf{j}$
27.	$\mathbf{p} = \mathbf{i} + 2\mathbf{j},\ \mathbf{v} = \mathbf{i} + 7\mathbf{j}$	$proj_{\mathbf{p}}(\mathbf{v}) = 3\mathbf{i} + 6\mathbf{j}$

3. Section 1-3

1. $\mathbf{u} \times \mathbf{v} = \langle 0, 0, -1 \rangle$
3. $\mathbf{u} \times \mathbf{v} = \langle 0, 0, -6 \rangle$
5. $\mathbf{u} \times \mathbf{v} = \langle 0, 0, 1 \rangle$
7. $\mathbf{u} \times \mathbf{v} = \langle -6, 39, -15 \rangle$
9. $\mathbf{u} \times \mathbf{v} = \langle 0, 0, 0 \rangle$
11. $Area = 3/2$
13. $Area = 2$
15. $Area = \frac{\sqrt{3}}{2}$
17. $Area = \frac{3}{2}\sqrt{2}$
19. $\mathbf{u} \times \mathbf{v} = -2\mathbf{k}$
21. $\mathbf{u} \times \mathbf{v} = 5\mathbf{i} - \mathbf{j} - 3\mathbf{k}$
23. $\mathbf{u} \times \mathbf{v} = -b\mathbf{i} + a\mathbf{j}$
25. $\mathbf{u} \times \mathbf{v} = b\mathbf{i} - a\mathbf{k}$

4. Section 1-4

1. $Volume = 12$
3. $Volume = 4$
5. $Volume = 5$
7. $Volume = lwh$
9. $z = \frac{x+y}{3}$
11. $z = -\frac{7}{2}x - \frac{11}{4}y + \frac{55}{4}$
13. $z = 0$
15. $y = x$
17. $z = 3$
19. $y = \frac{3}{2}x$
21. $z = 0$
23. $z = \frac{1}{2}x + y$

5. Section 1-5

Equation only: No sketches.

1. $y = x + 2$
3. $y^3 = x^2$
5. $y = x - 1 + 2\sqrt{x-1}$
7. $x^2 + y^2 = 4$
9. $\frac{x^2}{4} + \frac{y^2}{9} = 1$
11. $y = 2x^2 - 1$
13. $\frac{(x-1)^2}{4} + y^2 = 1$
15. $(x-1)^2 + (y-2)^2 = 1$
17. $x - 1 + \frac{(y-2)^2}{9} = 1$
19. $3y = 4x^2 - 2$
21. $(x-1)^2 + y^2 = 1$
23. $x + y = 1$
25. $\mathbf{r}(\theta) = \langle 3\cos(\theta) + 1, 3\sin(\theta) + 1 \rangle$
27. $\mathbf{r}(\theta) = \langle 5\cos(\theta) + 1, 5\sin(\theta) - 3 \rangle$
29. $\mathbf{r}(t) = \langle 3\cos(5t) + 1, 3\sin(5t) + 1 \rangle$

6. Section 1-6

1. $\mathbf{v}(t) = \langle 2t, 3t^2, 4t^3 \rangle, \quad \mathbf{a}(t) = \langle 2, 6t, 12t^2 \rangle$
3. $\mathbf{v}(t) = \left\langle -\frac{1}{t^2}, -\frac{2}{t^3}, -\frac{3}{2t^{5/2}} \right\rangle, \quad \mathbf{a}(t) = \left\langle \frac{2}{t^3}, \frac{6}{t^4}, \frac{15}{4t^{7/2}} \right\rangle$
5. $\mathbf{v}(t) = \langle -3\sin t, 5\cos t, -4\sin t \rangle, \quad \mathbf{a}(t) = \langle -3\cos t, -5\sin t, -4\cos t \rangle$
7. $\mathbf{v}(t) = \langle [\sec^2 t, -\csc^2 t, \sec(t) - \csc t \cot t] \rangle, \quad \mathbf{a}(t) = \langle [2\tan t \sec^2 t, -2\cot t \csc^2 t, \csc t \cot^2 t +$
9. $\mathbf{v}(t) = \langle 0, 0, \tan t \rangle \langle 0, 0, \sec^2(t) \rangle,$
11. $\mathbf{v}(t) = \left\langle 2t, \dfrac{1}{1+t^2} \right\rangle, \quad \mathbf{a}(t) = \left\langle 2, -\dfrac{2t}{(1+t^2)^2} \right\rangle$
13. $\mathbf{v}(t) = \langle -e^{-t}\sin t + e^{-t}\cos t, -e^{-t}\cos t - e^{-t}\sin t, -e^{-t}t + e^{-t} \rangle, \quad \langle -2e^{-t}\cos t, 2e^{-t}\sin t, e^{-t}t -$

Velocity only: No sketch.

15. $\mathbf{v}(1) = \langle 2, 4 \rangle$
17. $\mathbf{v}\left(\frac{\pi}{6}\right) = \left\langle -\frac{1}{2}, \frac{1}{2}\sqrt{3} \right\rangle$
19. $\mathbf{v}(0) = \langle 1, -1 \rangle$
21. $\mathbf{v}(2) = \langle 3, 2 \rangle$

23. $\mathbf{r}(t) = \langle t, 2t, 64t - 16t^2 \rangle$
    plane: $y = 2x$
    $t_{\max} = 2$
25. $\mathbf{r}(t) = \langle 1 + 72t, 3 + 38t, 65t - 16t^2 \rangle$
    plane: $\frac{89}{36} + \frac{19}{36}x = y$
    $t_{\max} = 2.03125$
27. $\mathbf{r}(t) = \langle 0, 0, -16t^2 \rangle$
    plane: undefined
    $t_{\max} = 0$
29. $\mathbf{r}(t) = \langle 72t, 38t, 65t - 16t^2 \rangle$
    plane: $72y = -32x$
    $t_{\max} = 2.03125$

7. Section 1-7

1. $\mathbf{T}(t) = \left\langle \frac{3}{5}, \frac{4}{5} \right\rangle,\ v = 5$
3. $\mathbf{T}(t) = \langle -\sin(2t), \cos(2t) \rangle,\ v = 2$
5. $\mathbf{T}(t) = \left[\frac{2t^2}{2t^2+1}, \frac{2t}{2t^2+1}, \frac{1}{2t^2+1} \right],\ v = 2t^2 + 1$
7. $\mathbf{T}(t) = \left\langle \frac{3}{5}\cos(t^2), \frac{4}{5}\cos(t^2), -\sin(t^2) \right\rangle,\ \ v = 10t^2$
9. $\mathbf{T}(t) = \left\langle \frac{2e^{2t}}{2e^{2t}+1}, \frac{2e^t}{2e^{2t}+1}, \frac{1}{2e^{2t}+1} \right\rangle,\quad v = 2e^{2t} + 1$

11. $L = 10$
13. $L = 2\pi$
15. $L = 2\pi$
17. $L = 2\pi$
19. $L = 3 + \ln(2)$
21. $L = \frac{20}{27}\sqrt{10} - \frac{2}{27}$

23. $s(t) = t^3$
25. $s(t) = 5t^2$
27. $s(t) = e^{2t} + t - 1$

8. Section 1-8

1. $\mathbf{N} = \left\langle \frac{-4}{5}, \frac{3}{5} \right\rangle,\ \kappa(t) = 0$
3. $\mathbf{N} = \langle -\cos(2t), -\sin(2t) \rangle,\ \kappa(t) = 1$
5. $\mathbf{N} = \langle -\cos(t), -\sin(t), 0 \rangle,\ \kappa(t) = \frac{3}{25}$
7. $\mathbf{r}(t) = \left\langle \frac{2t}{2t^2+1}, \frac{2t^2-1}{2t^2+1}, \frac{-2t}{2t^2+1} \right\rangle,\ \kappa(t) = \frac{2t}{(2t^2+1)^2}$
9. $\mathbf{r}(t) = \left\langle -\frac{3}{5}\sin(t^2), -\frac{4}{5}\sin(t^2), -\cos(t^2) \right\rangle,\quad \kappa(t) = \frac{1}{5}$
11. $\frac{dv}{dt} = 0,\quad \kappa(t) = 1$
13. $\frac{dv}{dt} = \frac{2t^2-1}{t^2},\quad \kappa(t) = \frac{2t}{(2t^2+1)^2}$
15. $\frac{dv}{dt} = 2\sqrt{6}\cos 2t,\quad \kappa(t) = 0$
17. $\frac{dv}{dt} = 4e^{2t},\quad \kappa(t) = \frac{2e^t}{(2e^t+1)^2}$