1. $\mathbb{R}^2$
2. $\mathbf{r}(t)$
3. (x, y)
4. (x, y, z)
5. $\mathbf{F}(x, y) = \langle y, x \rangle$
6. $(1, -1)$
7. $\mathbf{G}(x, y) = -x\mathbf{j}$
8. $\mathbf{i}$
9. $\mathbf{k}$
10. $\mathbf{F}(x, y, z) = F_1(x, y, z)\mathbf{i} + F_2(x, y, z)\mathbf{j} + F_3(x, y, z)\mathbf{k}$
11. $\mathbf{F}(x, y, z) = \langle x^2, xy \sin(z), y^3 \rangle$
12. $f(x, y) = x^2 + y^2$
13. $|\mathbf{F}(x, y)|$
14. ∇f
15. g
16. h
17. $1/2$
18. $f \neq g$
19. $\mathbf{v}$
20. $\mathbf{F} \cdot \mathbf{v}$
21. $\mathbf{v}_1 = \langle 200 \cos(70°), 200 \sin(70°) \rangle \approx \langle 68.404, 187.94 \rangle$
22. $0 \leq t \leq 1$
23. $\pi/2 \leq t \leq 5\pi/2$
24. C
25. P
26. Q
27. n
28. $\mathbf{r}_i$
29. $\Delta\mathbf{r}_i = \mathbf{r}_{i+1} - \mathbf{r}_i$
30. $\mathbf{r}_0, \ldots, \mathbf{r}_n$
31. $\mathbf{F}(r_1, r_2)$
32. $\sum_{i=0}^{n-1} \mathbf{F}(\mathbf{r}_i) \cdot \Delta\mathbf{r}_i$
33. $\int_C \mathbf{F} \cdot d\mathbf{r} = \lim_{|\Delta\mathbf{r}_i| \to 0} \sum_{i=0}^{n-1} \mathbf{F}(\mathbf{r}_i) \cdot \Delta\mathbf{r}_i$

34. $\langle P, Q, R \rangle$

35. $x > 0$

36. $x < 0$

37. $\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$

38. k

39. $\oint_C \mathbf{F} \cdot d\mathbf{r}$

40. $y = mx + b$

41. $d\mathbf{r} = \left\langle dx, \frac{2}{3}dx \right\rangle = \langle 1, \frac{2}{3} \rangle\, dx$

42. $\frac{\partial f}{\partial x} = xy$

43. $[a, b]$

44. $\Delta \mathbf{r}_i = \mathbf{r}(t_{i+1}) - \mathbf{r}(t_i) = \mathbf{r}(t_i + \Delta t) - \mathbf{r}(t_i) = \left(\frac{\mathbf{r}(t_i + \Delta t) - \mathbf{r}(t_i)}{\Delta t} \right) \Delta t$

45. $\mathbf{r}'(t_i)$

46. $\mathbf{F}(t) = \langle 54t(\cos(t))^2, 27(s\sin(t))^2, 3\cos(t) \rangle$

47. $\int_C \langle (3xy + e^z), x^2, (4z + xe^z) \rangle \cdot d\mathbf{r}$

48. $\int_{C_3} \langle M, N \rangle \cdot d\mathbf{r}$

49. $\mathbf{H}(x, y, z) = \langle 3x^2y, x^3 + 2yz^3, xz + 3y^2z^2 \rangle$

50. D

51. $f \colon \mathbb{R}^3 \to \mathbb{R}$

52. $\langle f_x(\mathbf{r}(t)), f_y(\mathbf{r}(t)), f_z(\mathbf{r}(t)) \rangle \cdot \langle x'(t), y'(t), z'(t) \rangle =$
$f_x\left(x(t), y(t), z(t)\right) x'(t) + f_y\left(x(t), y(t), z(t)\right) y'(t) + f_z\left(x(t), y(t), z(t)\right) z'(t).$

53. $\mathbf{H}(x, y, z) = \langle H_1, H_2, H_3 \rangle$

54. $A(x)$

55. L_x

56. $\int_{-h}^{h} F_2(a + t, b + h)dt = (2h)F_2(t_1^*, b + h)$

57. $\text{Flow Density}(a, b) = \lim_{h \to 0} \frac{\text{net flow}}{\text{area}} =$
$\lim_{h \to 0} \frac{(2h)(F_2(t_1^*, b+h) - F_2(t_2^*, b-h) + F_1(a+h, t_3^*) - F_1(a-h, t_1^*))}{4h^2}$

58. $\text{Flow Density}(a, b) = \lim_{h \to 0} \left[\frac{F_1(a+h, t_3^*) - F_1(a-h, t_1^*)}{2h} + \frac{F_2(t_1^*, b+h) - F_2(t_2^*, b-h)}{2h} \right]$

59. $\text{div}(\mathbf{F}) = \frac{\partial F_1}{\partial x} + \frac{\partial F_2}{\partial y}$

60. $\mathbf{G}(x, y) = \langle G_1(x, y, z), G_2(x, y, z), G_3(x, y, z) \rangle$

61. $div(\mathbf{F}_1) = 0$

62. $a^*_{\text{top}}, a^*_{\text{bottom}} \in (a - h, a + h)$

63. $\mathbf{i} \times \mathbf{j} = \mathbf{k} \qquad \mathbf{i} \times \mathbf{k} = -\mathbf{j} \qquad \mathbf{j} \times \mathbf{k} = \mathbf{i}$

64. $\mathbf{u}$

65. $\operatorname{curl}(\mathbf{F}) = \left(\frac{\partial F_3}{\partial y} - \frac{\partial F_2}{\partial z}\right)\mathbf{i} - \left(\frac{\partial F_3}{\partial x} - \frac{\partial F_1}{\partial z}\right)\mathbf{j} + \left(\frac{\partial F_2}{\partial x} - \frac{\partial F_1}{\partial y}\right)\mathbf{k}$

66. $2\cos(\theta)$

67. $\oint_C \mathbf{F} \cdot d\mathbf{r} = \iint_R \left(\dfrac{\partial F_2}{\partial x} - \dfrac{\partial F_1}{\partial y}\right) dA$

68. $\oint_{C_2} \mathbf{G} \cdot d\mathbf{r} = \int_0^3 \int_0^x y \, dy \, dx = \int_0^3 \left.\frac{y^2}{2}\right|_0^x dx = \int_0^3 \frac{x^2}{2} \, dx = \left.\frac{x^3}{6}\right|_0^3 = \frac{27}{6}$

69. $g(x, y) = \frac{1}{2}\ln(x^2 + y^2)$

70. $\oint_C \mathbf{F} \cdot d\mathbf{r} + \oint_{C_2} \mathbf{F} \cdot d\mathbf{r} = 0 \Leftrightarrow \oint_C \mathbf{F} \cdot d\mathbf{r} = \oint_{-C_2} \mathbf{F} \cdot d\mathbf{r}$

71. $\overline{x} = \frac{1}{A}\iint_D x \, dA \qquad \text{and} \qquad \overline{y} = \frac{1}{A}\iint_D y \, dA$

72. $D_{i,j}$

73. $S_{i,j} = |(\mathbf{r}_s \times \mathbf{r}_t)(s_i, t_j)|\Delta s \Delta t$

74. $\text{Flux} = \sum_{i=1}^{n}\sum_{j=1}^{m} |\mathbf{F}_{\perp Q_{i,j}}| \cdot S_{i,j}$

75. $\mathbf{w}_{i,j} = (\mathbf{r}_s \times \mathbf{r}_t)(s_i, t_j)$

76. $n, m \to \infty$

77. $t = \phi$

78. Y

79. B

80. $\mathbf{n}$

81. $z \geq 0$

82. $\iint_S \mathbf{F} \cdot \mathbf{N} \, dS = \iiint_Q \operatorname{div}(\mathbf{F}) \, dV$

83. $\mathbf{F} = \langle 2x + 3\sin(yz), -4y + e^{x^2}, 7z + \arctan(y^5)$

84. $0 \leq \rho \leq 3$