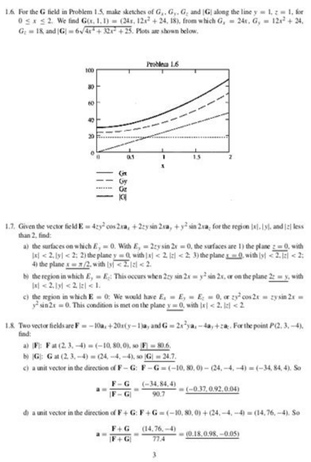

1.6. For the **G** field in Problem 1.5, make sketches of G_x, G_y, G_z and $|\mathbf{G}|$ along the line $y = 1$, $z = 1$, for $0 \le x \le 2$. We find $\mathbf{G}(x, 1, 1) = (24x, 12x^2 + 24, 18)$, from which $G_x = 24x$, $G_y = 12x^2 + 24$, $G_z = 18$, and $|\mathbf{G}| = 6\sqrt{4x^4 + 32x^2 + 25}$. Plots are shown below.

1.7. Given the vector field $\mathbf{E} = 4zy^2 \cos 2x\mathbf{a}_x + 2zy \sin 2x\mathbf{a}_y + y^2 \sin 2x\mathbf{a}_z$ for the region $|x|$, $|y|$, and $|z|$ less than 2, find:

a) the surfaces on which $E_y = 0$. With $E_y = 2zy \sin 2x = 0$, the surfaces are 1) the plane $z = 0$, with $|x| < 2$, $|y| < 2$; 2) the plane $y = 0$, with $|x| < 2$, $|z| < 2$; 3) the plane $x = 0$, with $|y| < 2$, $|z| < 2$; 4) the plane $x = \pi/2$, with $|y| < 2$, $|z| < 2$.

b) the region in which $E_y = E_z$: This occurs when $2zy \sin 2x = y^2 \sin 2x$, or on the plane $2z = y$, with $|x| < 2$, $|y| < 2$, $|z| < 1$.

c) the region in which $\mathbf{E} = 0$: We would have $E_x = E_y = E_z = 0$, or $zy^2 \cos 2x = zy \sin 2x = y^2 \sin 2x = 0$. This condition is met on the plane $y = 0$, with $|x| < 2$, $|z| < 2$.

1.8. Two vector fields are $\mathbf{F} = -10\mathbf{a}_x + 20x(y-1)\mathbf{a}_y$ and $\mathbf{G} = 2x^2y\mathbf{a}_x - 4\mathbf{a}_y + z\mathbf{a}_z$. For the point $P(2, 3, -4)$, find:

a) $|\mathbf{F}|$: $\mathbf{F}$ at $(2, 3, -4) = (-10, 80, 0)$, so $|\mathbf{F}| = 80.6$.

b) $|\mathbf{G}|$: $\mathbf{G}$ at $(2, 3, -4) = (24, -4, -4)$, so $|\mathbf{G}| = 24.7$.

c) a unit vector in the direction of $\mathbf{F} - \mathbf{G}$: $\mathbf{F} - \mathbf{G} = (-10, 80, 0) - (24, -4, -4) = (-34, 84, 4)$. So

$$\mathbf{a} = \frac{\mathbf{F} - \mathbf{G}}{|\mathbf{F} - \mathbf{G}|} = \frac{(-34, 84, 4)}{90.7} = (-0.37, 0.92, 0.04)$$

d) a unit vector in the direction of $\mathbf{F} + \mathbf{G}$: $\mathbf{F} + \mathbf{G} = (-10, 80, 0) + (24, -4, -4) = (14, 76, -4)$. So

$$\mathbf{a} = \frac{\mathbf{F} + \mathbf{G}}{|\mathbf{F} + \mathbf{G}|} = \frac{(14, 76, -4)}{77.4} = (0.18, 0.98, -0.05)$$

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