Topic: Scalar equation of a plane

Question: Find the scalar equation of the plane given by the point and the normal vector.

$$P(1,0,-1)$$

$$\langle 2,1,-2 \rangle$$

Answer choices:

A $\quad -2x - y + 2z + 4 = 0$

B $\quad 2x + y - 2z + 4 = 0$

C $\quad -2x - y + 2z - 4 = 0$

D $\quad 2x + y - 2z - 4 = 0$

Solution: D

We'll plug the values from the point $P(1,0,-1)$ into the formula for the tangent plane for $P_0(x_0, y_0, z_0)$.

$$a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$$

$$a(x - 1) + b(y - 0) + c\left[z - (-1)\right] = 0$$

$$a(x - 1) + by + c(z + 1) = 0$$

Since $\langle 2,1,-2 \rangle$ is the normal vector to the plane, we can plug those values into the equation for $n = \langle a, b, c \rangle$.

$$2(x - 1) + 1y + (-2)(z + 1) = 0$$

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

$$2x + y - 2z - 4 = 0$$

Topic: Scalar equation of a plane

Question: Find the scalar equation of the plane given by the point and the normal vector.

$$P(5,-4,3)$$

$$\langle -3,-3,-3\rangle$$

Answer choices:

A $\quad -3x-3y+3z+12=0$

B $\quad -3x-3y-3z+12=0$

C $\quad -3x-3y-3z-12=0$

D $\quad -3x-3y+3z-12=0$

Solution: B

We'll plug the values from the point $P(5,-4,3)$ into the formula for the tangent plane for $P_0(x_0, y_0, z_0)$.

$$a(x-x_0)+b(y-y_0)+c(z-z_0)=0$$

$$a(x-5)+b\left[y-(-4)\right]+c(z-3)=0$$

$$a(x-5)+b(y+4)+c(z-3)=0$$

Since $\langle -3,-3,-3\rangle$ is the normal vector to the plane, we can plug those values into the equation for $n=\langle a,b,c\rangle$.

$$-3(x-5)+(-3)(y+4)+(-3)(z-3)=0$$

$$-3(x-5)-3(y+4)-3(z-3)=0$$

$$-3x+15-3y-12-3z+9=0$$

$$-3x-3y-3z+12=0$$

Topic: Scalar equation of a plane

Question: Find the scalar equation of the plane given by the point and the normal vector.

$$P(-6,2,-5)$$

$$8\mathbf{i}-5\mathbf{j}+\mathbf{k}$$

Answer choices:

A $\quad 8x-5y+z+63=0$

B $\quad 8x-5y+z-63=0$

C $\quad -8x+5y-z+63=0$

D $\quad -8x+5y-z-63=0$

Solution: A

We'll plug the values from the point $P(-6,2,-5)$ into the formula for the tangent plane for $P_0(x_0, y_0, z_0)$.

$$a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$$

$$a\left[x - (-6)\right] + b(y - 2) + c\left[z - (-5)\right] = 0$$

$$a(x + 6) + b(y - 2) + c(z + 5) = 0$$

Since $8\mathbf{i} - 5\mathbf{j} + \mathbf{k}$ is the normal vector to the plane, we can plug those values into the equation for $n = \langle a, b, c \rangle$.

$$8(x + 6) + (-5)(y - 2) + 1(z + 5) = 0$$

$$8(x + 6) - 5(y - 2) + z + 5 = 0$$

$$8x + 48 - 5y + 10 + z + 5 = 0$$

$$8x - 5y + z + 63 = 0$$