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so many fake sites. this is the first one which worked! Many thanks

CHAPTER 1

1.1. Given the vector $\mathbf{M} = -10\mathbf{a}_x + 8\mathbf{a}_y - 6\mathbf{a}_z$ and $\mathbf{N} = 8\mathbf{a}_x + 7\mathbf{a}_y - 2\mathbf{a}_z$, find:

- a) a unit vector in the direction of $-\mathbf{M} + 2\mathbf{N}$.
 $-\mathbf{M} + 2\mathbf{N} = 10\mathbf{a}_x - 8\mathbf{a}_y + 6\mathbf{a}_z + 16\mathbf{a}_x - 14\mathbf{a}_y - 12\mathbf{a}_z = (26, 10, 0)$
 Thus $\mathbf{a} = \frac{(26, 10, 0)}{\sqrt{26^2 + 10^2}} = (0.92, 0.36, 0.11)$

- b) the magnitude of $5\mathbf{a}_x + \mathbf{N} - 3\mathbf{M}$.
 $(5, 0, 0) + (8, 7, -2) - (-30, 12, -21) = (43, -5, 22)$ and $\|(43, -5, 22)\| = 45.6$

- c) $|\mathbf{M}|2\mathbf{N}(\mathbf{M} + \mathbf{N})$.
 $|\mathbf{M}| = \sqrt{10^2 + 8^2 + 6^2} = 14.14$, $|\mathbf{N}| = \sqrt{8^2 + 7^2 + 2^2} = 11$, $(\mathbf{M} + \mathbf{N}) = (-2, 15, -8)$
 $|\mathbf{M}|2\mathbf{N}(\mathbf{M} + \mathbf{N}) = 14.14 \cdot 2 \cdot 11 \cdot \sqrt{(-2)^2 + 15^2 + 8^2} = (-5853, 3138, -2902)$

1.2. The three vertices of a triangle are located at $A(-1, 2, 5)$, $B(-4, -2, -3)$, and $C(1, 3, -2)$.

- a) Find the length of the perimeter of the triangle. Begin with $\mathbf{AB} = (-3, -4, -8)$, $\mathbf{BC} = (5, 5, 1)$, and $\mathbf{CA} = (-2, -1, 7)$. Then the perimeter will be $P = |\mathbf{AB}| + |\mathbf{BC}| + |\mathbf{CA}| = \sqrt{9 + 16 + 64} + \sqrt{25 + 25 + 1} + \sqrt{4 + 1 + 49} = 24.8$

- b) Find a unit vector that is directed from the midpoint of the side AB to the midpoint of side BC . The vector from the origin to the midpoint of AB is $\mathbf{M}_{AB} = \frac{1}{2}(\mathbf{A} + \mathbf{B}) = \frac{1}{2}(-5\mathbf{a}_x + 2\mathbf{a}_y)$. The vector from the origin to the midpoint of BC is $\mathbf{M}_{BC} = \frac{1}{2}(\mathbf{B} + \mathbf{C}) = \frac{1}{2}(-3\mathbf{a}_x + 6\mathbf{a}_y - 5\mathbf{a}_z)$. The vector from midpoint to midpoint is now $\mathbf{M}_{BC} - \mathbf{M}_{AB} = \frac{1}{2}(-2\mathbf{a}_x + 4\mathbf{a}_y - 5\mathbf{a}_z)$. The unit vector is therefore

$$\mathbf{a}_{BC,AB} = \frac{\mathbf{M}_{BC} - \mathbf{M}_{AB}}{|\mathbf{M}_{BC} - \mathbf{M}_{AB}|} = \frac{(-2\mathbf{a}_x + 4\mathbf{a}_y - 5\mathbf{a}_z)}{7.35} = -0.27\mathbf{a}_x + 0.54\mathbf{a}_y - 0.68\mathbf{a}_z$$

where factors of $1/2$ have cancelled.

- c) Show that the unit vector multiplied by scalar is equal to the vector from A to C and that the unit vector is therefore parallel to AC . First we find $\mathbf{AC} = 2\mathbf{a}_x + 8\mathbf{a}_y - 7\mathbf{a}_z$, which we recognize as $-7.35\mathbf{a}_{BC,AB}$. The vectors are thus parallel (but oppositely-directed).

1.3. The vector from the origin to the point A is given as $(6, -2, -4)$, and the unit vector directed from the origin toward point B is $(2, -2, 0)/3$. If points A and B are ten units apart, find the coordinates of point B .

- With $\mathbf{A} = (6, -2, -4)$ and $\mathbf{B} = \frac{1}{3}(2i, -2j, 0)$, we use the fact that $|\mathbf{B} - \mathbf{A}| = 10$, or $10 = \sqrt{(2 - 6)^2 + (-2 + 2)^2 + (0 + 4)^2} = 10$. Expanding, obtain $36 - 8i + 2i^2 + 16 + 16 + 16 = 100$ or $8i^2 - 8i - 44 = 0$. Thus $i = \frac{8 \pm \sqrt{64 + 1472}}{16} = 11.75$ (taking positive option) and so

$$\mathbf{B} = \frac{2}{3}(11.75\mathbf{a}_x - 2\mathbf{a}_y) = (7.83\mathbf{a}_x - 1.33\mathbf{a}_y)$$

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