Problems 12.3, Page 82

4. $(\vec{a}\cdot\vec{b})\vec{a} = (0(-3)+2(5)+1(4))(2\vec{\jmath}+\vec{k}) = 28\vec{\jmath}+14\vec{k}$

5. $(\vec{a}\cdot\vec{y})(\vec{c}\cdot\vec{z}) = (0(4)+2(-7)+1(0))(1(1)+6(-3)+0(-1)) = (-14)(-17) = 238$

6. $((\vec{c}\cdot\vec{c})\vec{a})\cdot\vec{a} = (\vec{c}\cdot\vec{c})(\vec{a}\cdot\vec{a}) = \|\vec{c}\|^2\|\vec{a}\|^2 = (1^2+6^2+0^2)(0^2+2^2+1^2) = (37)(5) = 185$

11. $3x+4y-z=7$ has normal vector $3\vec{\imath}+4\vec{\jmath}-\vec{k}$.

12. $2x-2z = 3x+3y$, or $x+3y+2z=0$, has normal vector $\vec{\imath}+3\vec{\jmath}+2\vec{k}$.

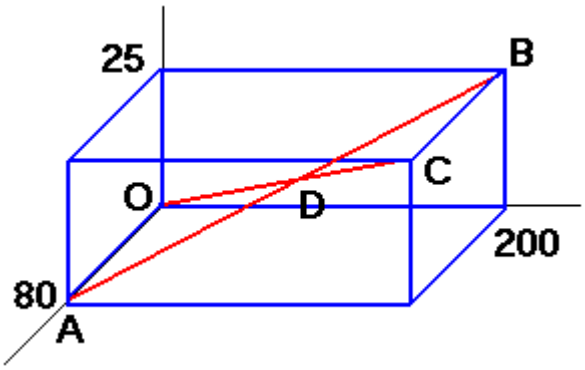
14. $5(x-0)+1(y-1)-2(z+1)=0$, or $5x+y-2z=3$.

15. $2(x-1)-3(y+1)+7(z-2)=0$, or $2x-3y+7z=19$.

16. $2(x-1)+4(y-0)-3(z+1)=0$, or $2x+4y-3z=5$.

18. (a) $AB = \sqrt{(4-2)^2+(2-2)^2+(1-2)^2} = \sqrt{5}$, $AC = \sqrt{(2-2)^2+(3-2)^2+(1-2)^2} = \sqrt{2}$, and $BC = \sqrt{(4-2)^2+(2-3)^2+(1-1)^2} = \sqrt{5}$, so AC is shortest.
(b) $\cos\angle BAC = (\vec{AB}\cdot\vec{AC})/(\|\vec{AB}\|\|\vec{AC}\|) = ((4-2)(2-2)+(2-2)(3-2)+(1-2)(1-2)/(\sqrt{5}\sqrt{2}) = 1/\sqrt{10}$.

22.



$$\begin{aligned}\cos\angle BDC &= \frac{\vec{DB}\cdot\vec{DC}}{\|\vec{DB}\|\,\|\vec{DC}\|} = \frac{(\frac{1}{2}\vec{AB})\cdot(\frac{1}{2}\vec{OC})}{\|\frac{1}{2}\vec{AB}\|\,\|\frac{1}{2}\vec{OC}\|} = \frac{\vec{AB}\cdot\vec{OC}}{\|\vec{AB}\|\,\|\vec{OC}\|} \\ &= \frac{(80\vec{\imath}+200\vec{\jmath}+25\vec{k})\cdot(-80\vec{\imath}+200\vec{\jmath}+25\vec{k})}{80^2+200^2+25^2} = \frac{34225}{47025} \approx 0.7278\end{aligned}$$

24. The component of $\vec{w}$ in the direction of $\vec{v}$ has length $(\vec{v}\cdot\vec{w})/\|\vec{v}\| = (2(5)+6(1))/\sqrt{2^2+6^2} \approx 2.5 < 5$ km/hr, so the results will not be disqualified.

28. $((\vec{b}\cdot\vec{c})\vec{a}-(\vec{a}\cdot\vec{c})\vec{b})\cdot\vec{c} = (\vec{b}\cdot\vec{c})(\vec{a}\cdot\vec{c})-(\vec{a}\cdot\vec{c})(\vec{b}\cdot\vec{c}) = 0$