MATH 4 T

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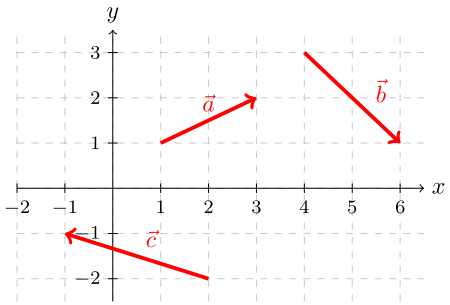
Points and vectors - level B

1. Given vectors $\vec{a}$, $\vec{b}$, $\vec{c}$, find $2\vec{a}+3\vec{b}-\vec{c}$.



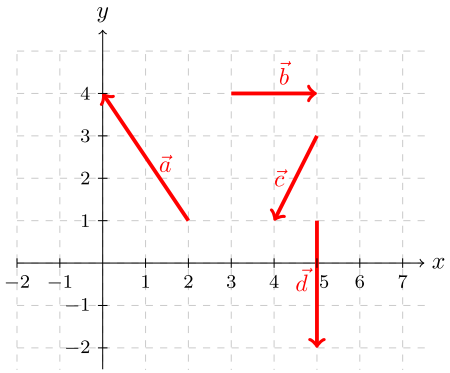
(a) $(7;7)$

(b) $(7;0)$

(c) $(7;-5)$

(d) $(13;-5)$

2. Given vectors $\vec{a}$, $\vec{b}$, $\vec{c}$, $\vec{d}$, find $\vec{a}+\vec{b}+\vec{c}+\vec{d}$.



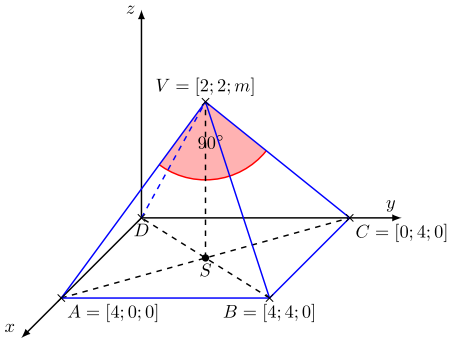
(a) $(2;-3)$

(b) $(-1;-2)$

(c) $(17;7)$

(d) $(6;10)$

3. Let $ABCDV$ be a right pyramid with a square base, such that its opposite edges contain a right angle (see the picture). Specify the missing coordinate of the apex V.



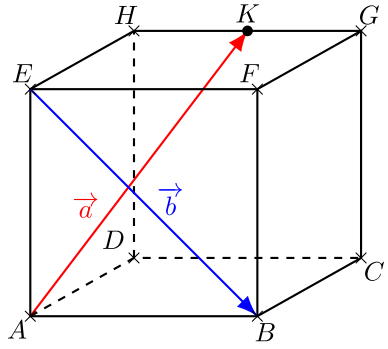
(a) $m=-2\sqrt{2}$

(b) $m=4\sqrt{2}$

(c) $m=2\sqrt{2}$

(d) $m=\sqrt{2}$

4. In the cube $ABCDEFGH$ find the angle φ between the vectors $\overrightarrow{b}=\overrightarrow{EB}$ and $\overrightarrow{a}=\overrightarrow{AK}$, where K is the midpoint of HG. Round φ to the nearest degree. Help: Choose the appropriate coordinate system.



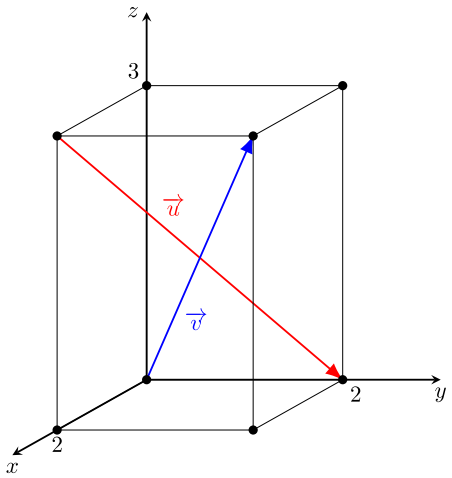
(a) $\varphi \doteq 80°$

(b) $\varphi \doteq 76°$

(c) $\varphi \doteq 104°$

(d) $\varphi \doteq 100°$

5. The vectors $\vec{u}$ and $\vec{v}$ are given by the figure. Find cosine of the angle φ between $\vec{u}$ and $\vec{v}$. Help: Use the dot product of the given vectors.



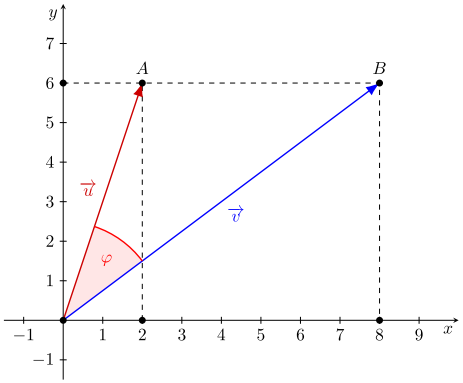
(a) $\cos\varphi = -\frac{9}{17}$

(b) $\cos\varphi = -\frac{\sqrt{17}}{2\sqrt{13}}$

(c) $\cos\varphi = \frac{9}{17}$

(d) $\cos\varphi = \frac{\sqrt{17}}{2\sqrt{13}}$

6. The vectors $\vec{u}$ and $\vec{v}$ are given by the figure. Find cosine of the angle φ between $\vec{u}$ and $\vec{v}$. Help: Use the dot product of the given vectors.



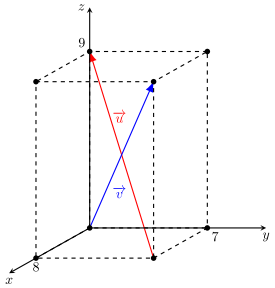
(a) $\cos\varphi = \frac{13\sqrt{10}}{50}$

(b) $\cos\varphi = \frac{3\sqrt{10}}{10}$

(c) $\cos\varphi = \frac{970}{50}$

(d) $\cos\varphi = \frac{\sqrt{10}}{5}$

7. Find the coordinates of the vectors $\vec{u}$ and $\vec{v}$ given by the picture and evaluate their dot product.



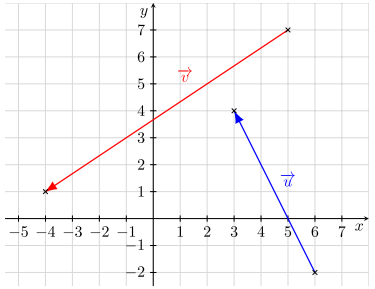
(a) $\vec{u} = (8;7;-9)$; $\vec{v} = (-8;-7;-9)$; $\vec{u}\cdot\vec{v} = (-64;-49;81)$

(b) $\vec{u} = (-8;-7;9)$; $\vec{v} = (8;7;9)$; $\vec{u}\cdot\vec{v} = (-64;-49;81)$

(c) $\vec{u} = (-8;-7;9)$; $\vec{v} = (8;7;9)$; $\vec{u}\cdot\vec{v} = -32$

(d) $\vec{u} = (-8;-7;9)$; $\vec{v} = (8;7;9)$; $\vec{u}\cdot\vec{v} = 0$

8. Find the coordinates of the vectors $\vec{u}$ and $\vec{v}$ given by the picture and evaluate their dot product.



(a) $\vec{u} = (3;-6)$; $\vec{v} = (9;6)$; $\vec{u}\cdot\vec{v} = -9$

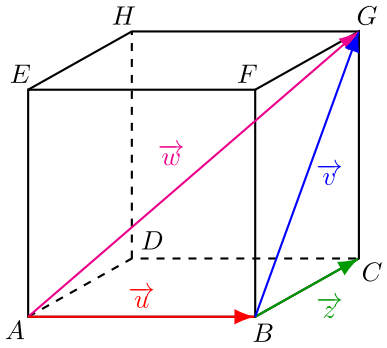
(b) $\vec{u} = (-3;6)$; $\vec{v} = (-9;-6)$; $\vec{u}\cdot\vec{v} = 9$

(c) $\vec{u} = (-3;6)$; $\vec{v} = (-9;-6)$; $\vec{u}\cdot\vec{v} = -9$

(d) $\vec{u} = (3;-6)$; $\vec{v} = (9;6)$; $\vec{u}\cdot\vec{v} = 0$

9. The vectors $\vec{u}$, $\vec{v}$, $\vec{w}$, $\vec{z}$ are indicated in a cube shown in the figure. The cube edge length is 1. Find the dot products of:

$$\vec{v}\cdot\vec{z}\ ,\quad \vec{u}\cdot\vec{v}\ ,\quad \vec{w}\cdot\vec{u}\ .$$



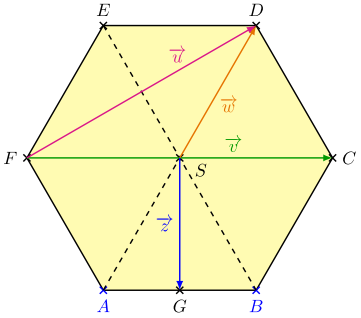
(a) $\vec{v}\cdot\vec{z}=1$, $\vec{u}\cdot\vec{v}=1$, $\vec{w}\cdot\vec{u}=\sqrt{3}$

(b) $\vec{v}\cdot\vec{z}=1$, $\vec{u}\cdot\vec{v}=0$, $\vec{w}\cdot\vec{u}=1$

(c) $\vec{v}\cdot\vec{z}=\frac{\sqrt{2}}{2}$, $\vec{u}\cdot\vec{v}=1$, $\vec{w}\cdot\vec{u}=\sqrt{3}$

(d) $\vec{v}\cdot\vec{z}=\sqrt{2}$, $\vec{u}\cdot\vec{v}=0$, $\vec{w}\cdot\vec{u}=1$

10. Let $ABCDEF$ be a regular hexagon with the centre S and the side of length 3 cm. The point G is the midpoint of the segment AB. The vectors $\vec{u}$, $\vec{v}$, $\vec{w}$, $\vec{z}$ are indicated in the hexagon shown in the picture. Find the dot product of: $\vec{v}\cdot\vec{w}$, $\vec{v}\cdot\vec{z}$ and $\vec{v}\cdot\vec{u}$.



(a) $\vec{v}\cdot\vec{w}=9$, $\vec{v}\cdot\vec{z}=0$, $\vec{v}\cdot\vec{u}=9\sqrt{6}$

(b) $\vec{v}\cdot\vec{w}=\frac{9}{2}$, $\vec{v}\cdot\vec{z}=0$, $\vec{v}\cdot\vec{u}=9\sqrt{6}$

(c) $\vec{v}\cdot\vec{w}=\frac{9}{2}$, $\vec{v}\cdot\vec{z}=1$, $\vec{v}\cdot\vec{u}=27$

(d) $\vec{v}\cdot\vec{w}=9$, $\vec{v}\cdot\vec{z}=0$, $\vec{v}\cdot\vec{u}=27$

Answers (Points and vectors - level B): 1d, 2b, 3c, 4c, 5a, 6a, 7c, 8c, 9b, 10d,