1 Angles from the Dot Product

Let

$$\vec{\boldsymbol{a}} = \hat{\boldsymbol{x}} - 3\hat{\boldsymbol{y}} - \hat{\boldsymbol{z}}$$
$$\vec{\boldsymbol{b}} = \hat{\boldsymbol{x}} + \hat{\boldsymbol{y}} + 2\hat{\boldsymbol{z}}$$
$$\vec{\boldsymbol{c}} = -2\hat{\boldsymbol{x}} - \hat{\boldsymbol{y}} + \hat{\boldsymbol{z}}$$
$$\vec{\boldsymbol{d}} = -\hat{\boldsymbol{x}} - \hat{\boldsymbol{y}} + \hat{\boldsymbol{z}}$$

Use the dot product to determine: Which pairs of these vectors (if any)

(a) Are perpendicular?

(b) Are parallel?

(c) Have an angle less than $\pi/2$ between them?

(d) Have an angle of more than $\pi/2$ between them?