1) Determine the work done by each force $\vec{F}$, in Joules, for each object moving along $\vec{s}$.
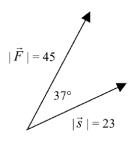
a) $\vec{F}$ = [3, –2], $\vec{s}$ = [1, 8]
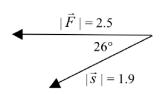
b) $\vec{F}$ = [8, –9], $\vec{s}$ = [–3, 7]

2) Determine the work done by the force $\vec{F}$, in Joules, for each object moving along $\vec{s}$.

a)

$|\vec{F}| = 45$

$37°$

$|\vec{s}| = 23$

b)

$|\vec{F}| = 2.5$

$26°$

$|\vec{s}| = 1.9$

3) Determine the angle between the vectors in each pair.

a) $\vec{p}$ = [6, 7] and $\vec{q}$ = [3, 2]

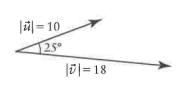**b)** $\vec{r}$ = [–1, –7] and $\vec{s}$ = [5, 4]

4) Determine the projection of the first vector on the second.
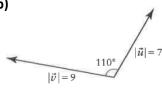
a) $\vec{a}$ = [6, –1], $\vec{b}$ = [3, –4]

b) $\vec{c}$ = [6, 7], $\vec{d}$ = [3, 2]

5) Determine the projection of $\vec{u}$ on $\vec{v}$

a)

$|\vec{u}| = 10$
$25°$
$|\vec{v}| = 18$

b)

$|\vec{u}| = 7$
$110°$
$|\vec{v}| = 9$

c)

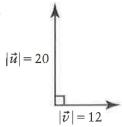$|\vec{u}| = 20$
$|\vec{v}| = 12$

6) For each of the following, find the magnitude of the projection of $\vec{x}$ on $\vec{y}$ and also the vector projection of $\vec{x}$ on $\vec{y}$.

a) $\vec{x} = [1,1], \vec{y} = [1,-1]$

b) $\vec{x} = [2,5], \vec{y} = [-5,12]$

7) ΔDEF has vertices D(−3, 5), E(2, 3), and F(6, 7). Calculate ∠DEF.

8) How much work is done against gravity by the orderly pushing an 85 kg person up a 5 m ramp inclined at an angle of 15° to the horizontal?

9) A stage lamp is dragged 15 m along level ground by a 120 N force applied at an angle of 35° to the ground. It is then dragged up a 12m ramp, inclined at 15° to the ground, onto a stage using the same force. Find the total work done.

10) A box on a wagon pulled a distance of 35 m by a 27 N force applied at an angle of 40° to the ground. The box is then lifted a distance of 1.5 m and placed on a table by exerting a force of 37 N. Find the total work done.

ANSWER KEY
1)a) −13 **b)** −87
2)a) 826.59 **b)** 4.27
3)a) θ = 15.71° **b)** θ = 136.79°
4)a) $\left[\frac{66}{25}, -\frac{88}{25}\right]$ **b)** $\left[\frac{96}{13}, \frac{64}{13}\right]$
5)a) 9.06$\hat{v}$ **b)** −2.39$\hat{v}$ **c)** $\vec{0}$
6) magnitude = 0, vector projection: $\vec{0}$ b) magnitude = $\frac{50}{13}$, vector projection: $\left[\frac{-250}{169}, \frac{600}{169}\right]$
7) 113.2°
8) 1077.98 J
9) 2827.63 J
10) 779.4 J