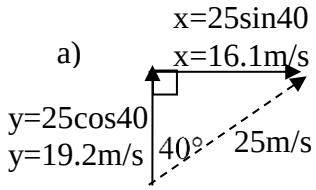
Physics 20 - Lesson 11
Vector Addition-Components

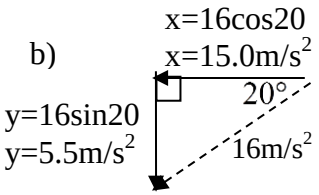
Possible 90/90

1) /9

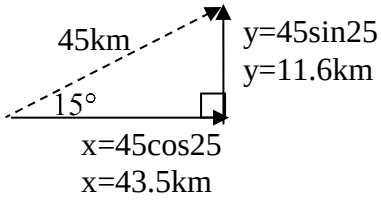
a)



b)



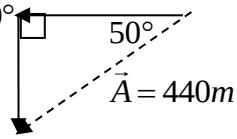
c)

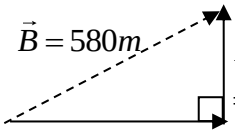


2) /16

$A_x = -440\cos 50° = -282.83$

$A_y = -440\sin 50°$
$= -337.06$





$B_y = 580\sin 60°$
$= 502.29m$

$B_x = 580\cos 60°$
$= 290m$

a) distance

$\Delta d = 440m + 580m$

$\boxed{\Delta d = 1020m}$

b) displacement

$\Delta\vec{d}_x = \vec{A}_x + \vec{B}_x = -282.83 + 290$

$\Delta\vec{d}_x = +7.17m$

$\Delta\vec{d}_y = \vec{A}_y + \vec{B}_y = -337.06 + 502.29$

$\Delta\vec{d}_y = +165.23m$

$\Delta d = \sqrt{165.23^2 + 7.17^2}$

$\Delta d = 165.4m$

$\theta = \tan^{-1}\dfrac{7.17}{165.23}$

$\theta = 2.5°$ E of N

$\boxed{\Delta\vec{d} = 165.4m\ [2.5°\text{ E of N}]}$

c) speed

$$v_{avg} = \frac{\Delta d}{\Delta t}$$

$$v_{avg} = \frac{1020m}{15\min}$$

$$v_{avg} = 68\,{}^{m}\!/_{\min}$$

3)

a) distance $\Delta d = 440m + 580m = 1020m$

b) displacement

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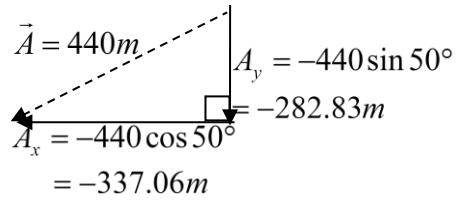
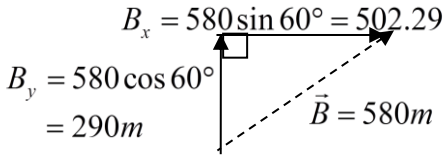
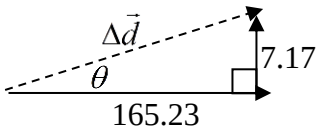




$\Delta d_x = -337.06 + 502.29$
$= 165.23$
$\Delta d_y = -282.83 + 290$
$= 7.17$



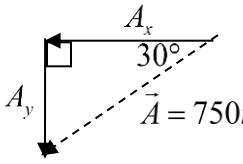
$\Delta d = \sqrt{7.17^2 + 165.23^2}$
$= 165.4m$
$\tan\theta = \dfrac{7.17}{165.23}$
$\theta = 2.5°$ N of E
$\Delta\vec{d} = 165.4m$ [2.5° N of E]

c) speed $V_{avg} = \dfrac{\Delta d}{\Delta t} = \dfrac{1020m}{15\min} = 68\,{}^{m}\!/_{\min}$

4)

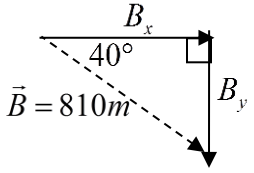
/14

$\vec{A}$ $\Delta d = 5.0\,{}^{m}\!/_{s}(150s) = 750m$



$A_x = -750\cos 30$
$= -649.52$
$A_y = -750\sin 30$
$= -375$

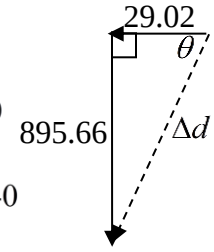
$\vec{B}$ $\Delta d = 3.0\,{}^{m}\!/_{s}(270s) = 810m$



$B_x = 810\cos 40$
$= 620.50$
$B_y = -810\sin 40$
$= -520.66$

a) $V_{avg} = \dfrac{\Delta d}{\Delta t} = \dfrac{750m + 810m}{25\min + 4.5\min} = 222.9\,{}^{m}\!/_{\min}\,(3.7\,{}^{m}\!/_{s})$

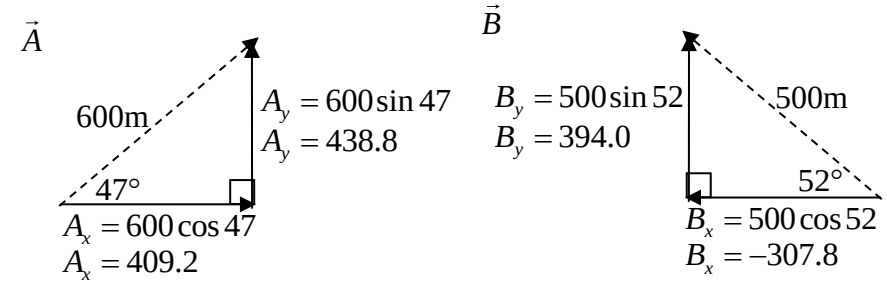
b) $\Delta d_x = -649.82 + 620.50 = -29.02$
$\Delta d_y = -375 - 520.50 = -895.66$

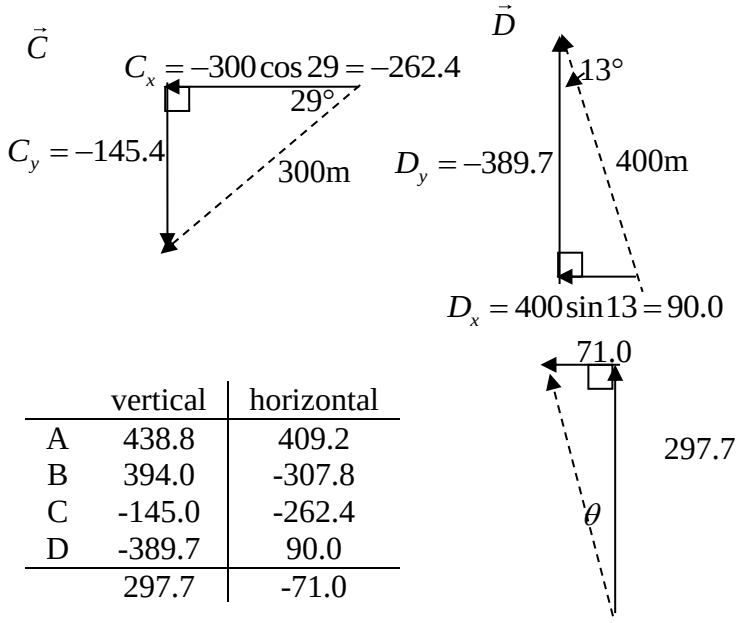


$\Delta d = \sqrt{29.02^2 + 895.66^2}$
$\Delta d = 896.13m$
$\tan\theta = \dfrac{895.66}{29.02}$ θ=88.1°

$\vec{d} = 896m$[88.1° S of W]

5) /14





	vertical	horizontal
A	438.8	409.2
B	394.0	-307.8
C	-145.0	-262.4
D	-389.7	90.0
	297.7	-71.0

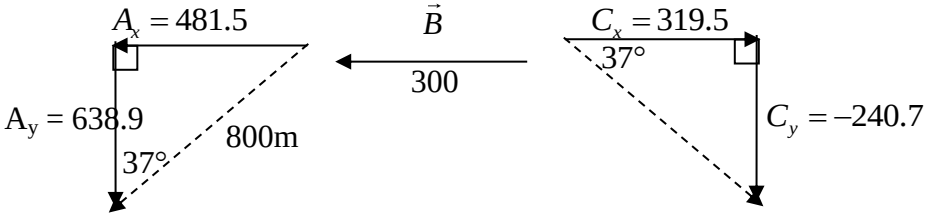
$\Delta\vec{d} = \sqrt{71.0^2 + 297.7^2} = 306\text{m}$

$\tan\theta = \frac{71}{297.7}$ θ=13° W of N

$\boxed{\Delta\vec{d} = 306m \text{ [13° W of N]}}$

6) /12

a)



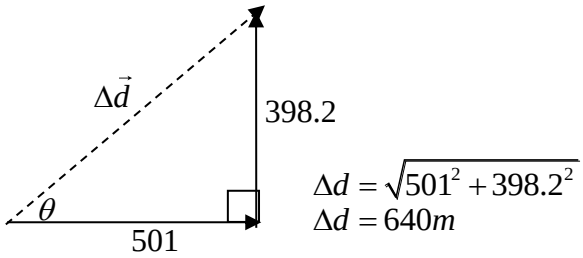
b) time $V = \frac{\Delta d}{\Delta t}$

$\Delta t = \frac{\Delta d}{V} = \frac{800 + 300 + 400m}{15\,{}^{m}\!/_{s}}$

$\Delta t = 100s$

	vertical	horizontal
A	638.9	481.5
B	0	-300
C	-240.7	319.5
	398.2	501

c)crow $V_{avg} = \frac{\Delta d}{\Delta t} = \frac{640m}{100s} = 6.4\,{}^{m}\!/_{s}$

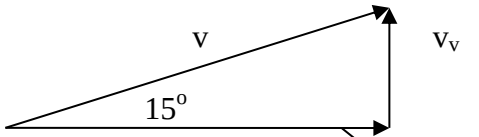


$\Delta d = \sqrt{501^2 + 398.2^2}$

$\Delta d = 640m$

7)

a)



v_h = 200 km/h

The motion of the shadow is the horizontal component of motion for the airplane.

$$\cos 15^o = \frac{200km/h}{v}$$

$$v = \frac{200km/h}{\cos 15^o}$$

v = **207 km/h**

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b)

$$\tan 15^o = \frac{v_v}{200km/h}$$

$$v_v = 200km/h(\tan 15^o)$$

$$v_v = 53.59km/h$$

$$t = \frac{d_v}{v_v} = \frac{1.00km}{53.59km/h}$$

$$t = 0.0187h$$

t = **1.1 min**