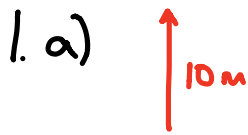
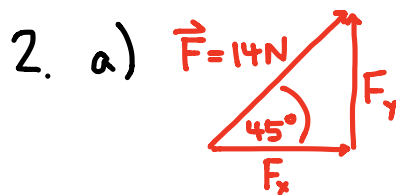
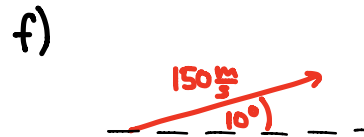
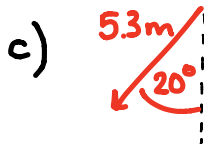


VECTORS - SOLUTIONS



b)

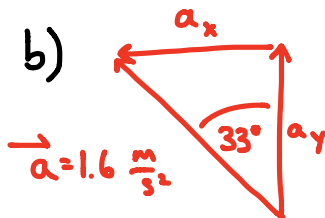


$$F_y = 14 \sin 45^\circ$$

$$= 9.9 \text{ N NORTH}$$

$$F_x = 14 \cos 45^\circ$$

$$= 9.9 \text{ N EAST}$$

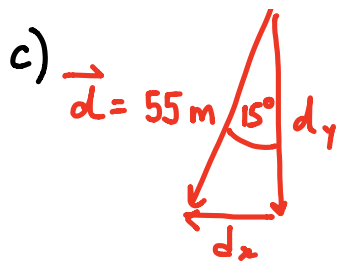


$$a_x = 1.6 \sin 33^\circ$$

$$= 0.87 \frac{\text{m}}{\text{s}^2} \text{ WEST}$$

$$a_y = 1.6 \cos 33^\circ$$

$$= 1.3 \frac{\text{m}}{\text{s}^2} \text{ NORTH}$$

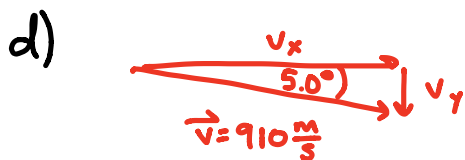


$$d_y = 55 \cos 15^\circ$$

$$= 53 \text{ m SOUTH}$$

$$d_x = 55 \sin 15^\circ$$

$$= 14 \text{ m WEST}$$

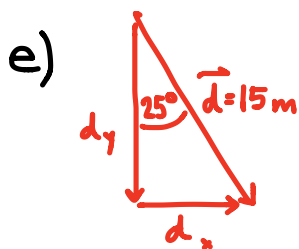


$$v_x = 910 \cos 5.0^\circ$$

$$= 907 \frac{\text{m}}{\text{s}} \rightarrow 910 \frac{\text{m}}{\text{s}} \text{ EAST}$$

$$v_y = 910 \sin 5^\circ$$

$$= 79 \frac{\text{m}}{\text{s}} \text{ SOUTH}$$

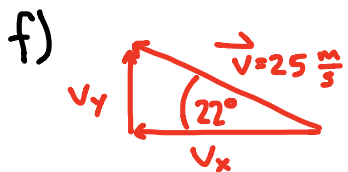


$$d_y = 15 \cos 25^\circ$$

$$= 14 \text{ m SOUTH}$$

$$d_x = 15 \sin 25^\circ$$

$$= 6.3 \text{ m EAST}$$



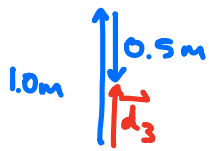
$$v_x = 25 \cos 22^\circ$$

$$= 23 \frac{\text{m}}{\text{s}} \text{ WEST}$$

$$v_y = 25 \sin 22^\circ$$

$$= 9.4 \frac{\text{m}}{\text{s}} \text{ NORTH}$$

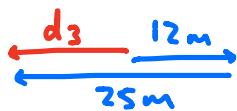
3. a) $\vec{d}_1 + \vec{d}_2 = \vec{d}_3$



$$d_3 = 1.0 - 0.5$$

$$= 0.5 \text{ m NORTH}$$

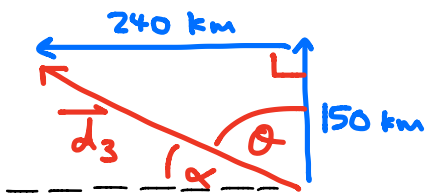
b) $\vec{d}_1 + \vec{d}_2 = \vec{d}_3$



$$d_3 = 25 - 12$$

$$= 13 \text{ m WEST}$$

c) $\vec{d}_1 + \vec{d}_2 = \vec{d}_3$



$$d_3^2 = 150^2 + 240^2$$

$$d_3 = \sqrt{150^2 + 240^2}$$

$$= 283.02 \text{ km}$$

$$\tan \theta = \frac{240}{150}$$

$$\theta = \tan^{-1}\left(\frac{240}{150}\right)$$

$$= 57.99^\circ$$

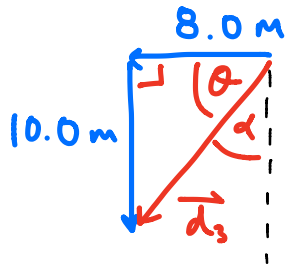
$$\alpha = 90 - \theta$$

$$= 90 - 57.99$$

$$= 32.01^\circ$$

$$280 \text{ km } 32^\circ \text{ NORTH OF WEST}$$

$$d) \vec{d}_1 + \vec{d}_2 = \vec{d}_3$$



$$d_3^2 = 8.0^2 + 10.0^2$$

$$d_3 = \sqrt{8.0^2 + 10.0^2}$$

$$= 12.806 \text{ m}$$

$$\tan \theta = \frac{10.0}{8.0}$$

$$\theta = \tan^{-1}\left(\frac{10.0}{8.0}\right)$$

$$= 51.34^\circ$$

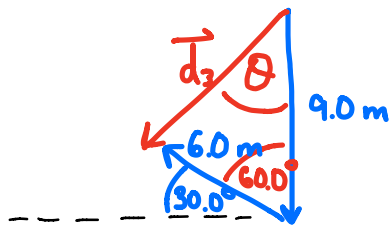
$$\alpha = 90 - \theta$$

$$= 90 - 51.34$$

$$= 38.66^\circ$$

13 m 39° WEST OF SOUTH

$$e) \vec{d}_1 + \vec{d}_2 = \vec{d}_3$$



$$d_3^2 = 9.0^2 + 6.0^2 - 2(9.0)(6.0)\cos 60.0^\circ$$

$$= 63$$

$$d_3 = 7.937 \text{ m}$$

$$\frac{\sin \theta}{6.0} = \frac{\sin 60.0^\circ}{7.937}$$

$$\sin \theta = \frac{6.0 \sin 60.0^\circ}{7.937}$$

$$\theta = \sin^{-1}\left(\frac{6.0 \sin 60.0^\circ}{7.937}\right)$$

$$= 40.89^\circ$$

7.9 m 41° WEST OF SOUTH

f) $\vec{d}_1 + \vec{d}_2 = \vec{d}_3$



$$d_3^2 = 182^2 + 40.0^2 - 2(182)(40.0)\cos 160^\circ$$

$$= 48405.92$$

$$d_3 = 220.01 \text{ km}$$

$$\frac{\sin \theta}{40.0} = \frac{\sin 160.0^\circ}{220.01}$$

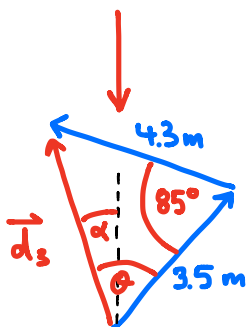
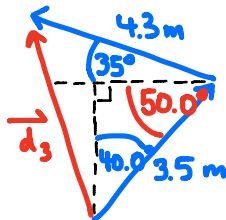
$$\sin \theta = \frac{40.0 \sin 160.0^\circ}{220.01}$$

$$\theta = \sin^{-1}\left(\frac{40.0 \sin 160.0^\circ}{220.01}\right)$$

$$= 3.565^\circ$$

220 km 3.6° SOUTH OF EAST

g) $\vec{d}_1 + \vec{d}_2 = \vec{d}_3$



$$d_3^2 = 3.5^2 + 4.3^2 - 2(3.5)(4.3)\cos 85^\circ$$

$$= 28.1166$$

$$d_3 = 5.3025$$

$$\frac{\sin \theta}{4.3} = \frac{\sin 85^\circ}{5.3025}$$

$$\sin \theta = \frac{4.3 \sin 85^\circ}{5.3025}$$

$$\theta = \sin^{-1}\left(\frac{4.3 \sin 85^\circ}{5.3025}\right)$$

$$= 53.8865^\circ$$

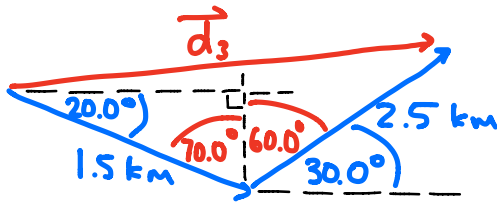
$$\alpha = \theta - 40.0$$

$$= 53.8865 - 40.0$$

$$= 13.8865^\circ$$

5.3 m 14° WEST OF NORTH

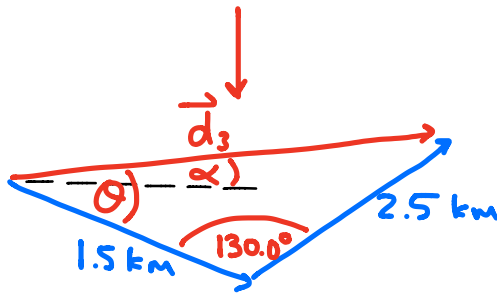
$$h) \vec{d}_1 + \vec{d}_2 = \vec{d}_3$$



$$d_3^2 = 1.5^2 + 2.5^2 - 2(1.5)(2.5)\cos 130.0^\circ$$

$$= 13.3209$$

$$d_3 = 3.6498 \text{ km}$$



$$\frac{\sin \theta}{2.5} = \frac{\sin 130.0^\circ}{3.6498}$$

$$\sin \theta = \frac{2.5 \sin 130^\circ}{3.6498}$$

$$\theta = \sin^{-1}\left(\frac{2.5 \sin 130^\circ}{3.6498}\right)$$

$$= 31.6492^\circ$$

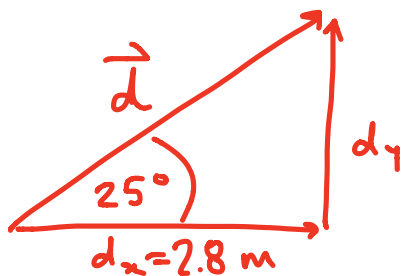
$$\alpha = \theta - 20.0$$

$$= 31.6492 - 20.0$$

$$= 11.65^\circ$$

3.6 km 12° NORTH OF EAST

4.

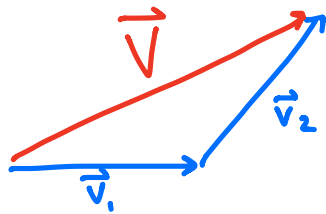


$$\tan 25^\circ = \frac{d_y}{2.8}$$

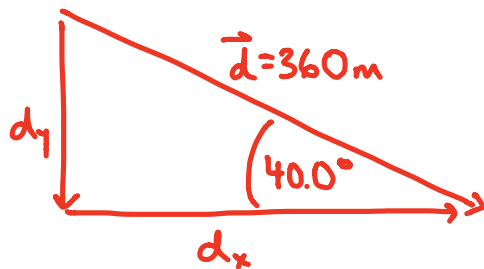
$$d_y = 2.8 \tan 25^\circ$$

$$= 1.3 \text{ m UP}$$

5. $\vec{V} = \vec{V}_1 + \vec{V}_2$



6. a)



$$d_x = 360 \cos 40.0^\circ$$

$$= 280 \text{ m}$$

b) $d_y = 360 \sin 40.0^\circ$

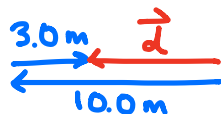
$$= 230 \text{ m}$$

7. a) $\vec{d} = \vec{x}_f - \vec{x}_i$

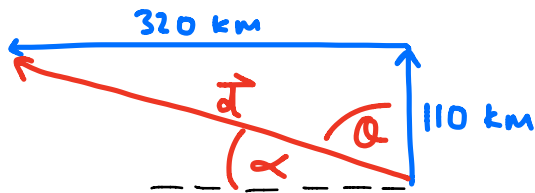
$$\vec{d} = \vec{x}_f + (-\vec{x}_i)$$

$$\vec{d} = 10.0 - 3.0 = 7.0$$

$$= 7.0 \text{ m WEST}$$



b) $\vec{d} = \vec{x}_f - \vec{x}_i$
 $\vec{d} = \vec{x}_f + (-\vec{x}_i)$



$$d^2 = 110^2 + 320^2$$

$$d = \sqrt{110^2 + 320^2}$$

$$= 338.378 \text{ km}$$

$$\tan \theta = \frac{320}{110}$$

$$\theta = \tan^{-1}\left(\frac{320}{110}\right)$$

$$= 71.03^\circ$$

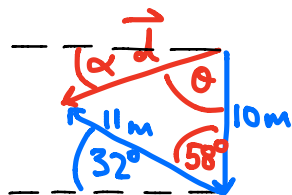
$$\alpha = 90 - \theta$$

$$= 90 - 71.03$$

$$= 18.97^\circ$$

340 km 19° NORTH OF WEST

c) $\vec{d} = \vec{x}_f - \vec{x}_i$
 $= \vec{x}_f + (-\vec{x}_i)$



$$d^2 = 10^2 + 11^2 - 2(10)(11)\cos 58^\circ$$

$$= 104.4178$$

$$d = 10.2185$$

$$\frac{\sin \theta}{11} = \frac{\sin 58^\circ}{10.2185}$$

$$\sin \theta = \frac{11 \sin 58^\circ}{10.2185}$$

$$\theta = \sin^{-1}\left(\frac{11 \sin 58^\circ}{10.2185}\right)$$

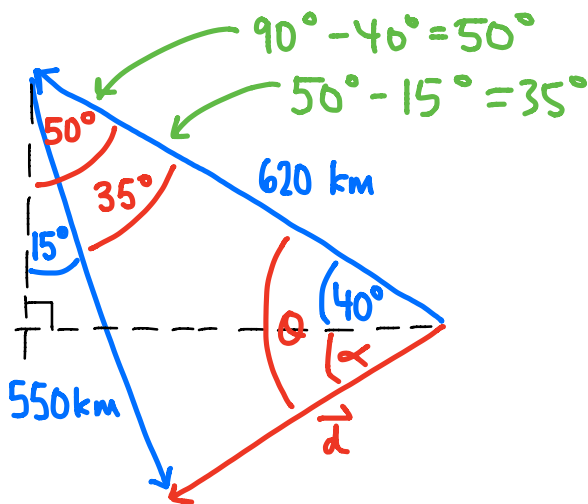
$$= 65.91^\circ$$

$$\begin{aligned}\alpha &= 90 - \theta \\ &= 90 - 65.91 \\ &= 24.09^\circ\end{aligned}$$

10 m 24° SOUTH OF WEST

$$\begin{aligned}d) \quad \vec{d} &= \vec{x}_f - \vec{x}_i \\ \vec{d} &= \vec{x}_f + (-\vec{x}_i)\end{aligned}$$

$$\begin{aligned}d^2 &= 620^2 + 550^2 - 2(620)(550)\cos 35^\circ \\ &= 128238.31 \\ d &= 358.1038 \text{ km}\end{aligned}$$

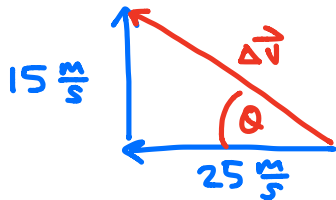


$$\begin{aligned}\frac{\sin \theta}{550} &= \frac{\sin 35^\circ}{358.1038} \\ \sin \theta &= \frac{550 \sin 35^\circ}{358.1038} \\ \theta &= \sin^{-1}\left(\frac{550 \sin 35^\circ}{358.1038}\right) \\ &= 61.76^\circ\end{aligned}$$

$$\begin{aligned}\alpha &= \theta - 40 \\ &= 61.76 - 40 \\ &= 21.76\end{aligned}$$

360 km 22° SOUTH OF WEST

8. $\Delta \vec{V} = \vec{V}_f - \vec{V}_i$
 $\Delta \vec{V} = \vec{V}_f + (-\vec{V}_i)$



$$(\Delta v)^2 = 25^2 + 15^2$$

$$\Delta v = \sqrt{25^2 + 15^2}$$

$$= 29.1548 \frac{m}{s}$$

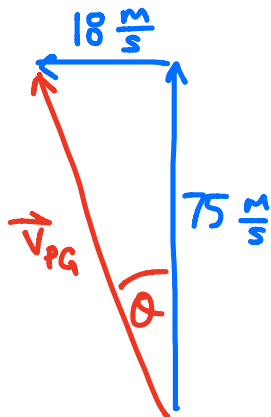
$$\tan \theta = \frac{15}{25}$$

$$\theta = \tan^{-1}\left(\frac{15}{25}\right)$$

$$= 30.96^\circ$$

$29 \frac{m}{s}$ 31° NORTH OF WEST

9. $\vec{V}_{PA} + \vec{V}_{AG} = \vec{V}_{PG}$



$$V_{PG}^2 = 75^2 + 18^2$$

$$V_{PG} = \sqrt{75^2 + 18^2}$$

$$= 77.129 \frac{m}{s}$$

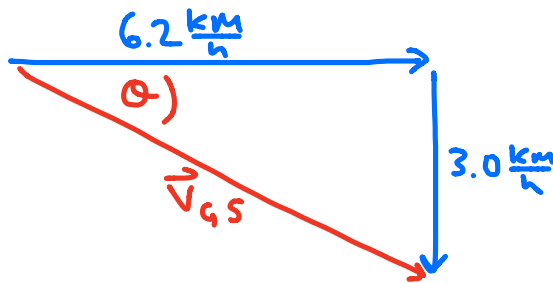
$$\tan \theta = \frac{18}{75}$$

$$\theta = \tan^{-1}\left(\frac{18}{75}\right)$$

$$= 13.496^\circ$$

$77 \frac{\text{m}}{\text{s}}$ 13° WEST OF NORTH

10. a) $\vec{V}_{GW} + \vec{V}_{WS} = \vec{V}_{GS}$



$$(\vec{V}_{GS})^2 = 6.2^2 + 3.0^2$$

$$\vec{V}_{GS} = \sqrt{6.2^2 + 3.0^2}$$

$$= 6.888 \text{ km/h}$$

$$\tan \theta = \frac{3.0}{6.2}$$

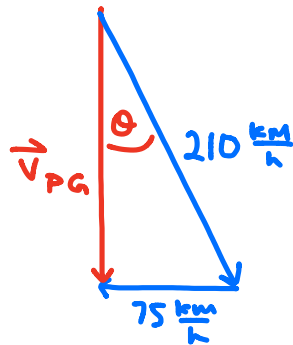
$$\theta = \tan^{-1}\left(\frac{3.0}{6.2}\right)$$

$$= 25.81^\circ$$

$6.9 \frac{\text{km}}{\text{h}}$ 26° SOUTH OF EAST

b) $6.2 \frac{\text{km}}{\text{h}}$ EAST

$$11. \vec{V}_{PA} + \vec{V}_{AG} = \vec{V}_{PG}$$



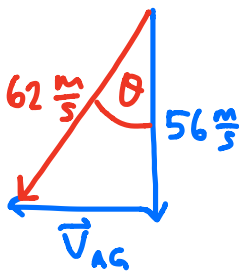
$$\sin \theta = \frac{75}{210}$$

$$\theta = \sin^{-1}\left(\frac{75}{210}\right)$$

$$= 20.92$$

21° EAST OF SOUTH

$$12. a) \vec{V}_{PA} + \vec{V}_{AG} = \vec{V}_{PG}$$



$$62^2 = 56^2 + V_{AG}^2$$

$$V_{AG}^2 = 62^2 - 56^2$$

$$V_{AG} = \sqrt{62^2 - 56^2}$$

$$= 27 \frac{m}{s}$$

b)

$$\cos \theta = \frac{56}{62}$$

$$\theta = \cos^{-1}\left(\frac{56}{62}\right)$$

$$= 25.41$$

25° WEST OF SOUTH