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8.4

1) a) Home → Work = 42 mph

b) Home → Work = 12 miles

c) Work → School = 28 mph

d) 12 - 3 = 9
↳ negative direction so -9 miles

e) School → Home = 34 mph

2) i) c - it is falling to the ground, so -ve direction, so velocity and acceleration are -ve

ii) b - this is because the velocity is positive and acceleration is negative - particle slows down

iii) a - both velocity and acceleration increases (+ve)

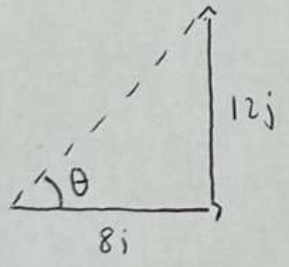
iv) d - as the helicopter is lowering to the ground, velocity would decrease, acceleration opposes the direction of motion, so it is slowing down

3) a) Speed = magnitude of vector $\underline{v}$

$|\underline{v}| = \sqrt{(8)^2 + (12)^2} = 14.4222$

↳ $\underline{14.4\ ms^{-2}}$ (3 s.f)

b)



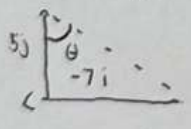
$\tan\theta = \frac{12}{8}$

$\tan^{-1}\left(\frac{12}{8}\right) = \underline{56.3^\circ}$
↳ 3 s.f

4) speed = magnitude of vector $\underline{a}$

a) $|\underline{a}| = \sqrt{(-7)^2 + (5)^2} = \underline{7.4\ ms^{-2}}$

b)



↳ $\tan\theta = \frac{7}{5}$ → $\tan^{-1}\left(\frac{7}{5}\right)$

$= 54.46$

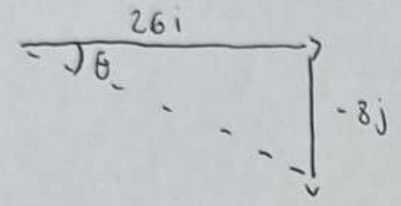
$= \underline{54.5^\circ}$ (3 s.f)

5) a) $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

$10i + 5j + 16i - 13j = \underline{26i - 8j} \rightarrow \overrightarrow{AC}$

$|\overrightarrow{AC}| = \sqrt{(26)^2 + (-8)^2} = \underline{27.2\text{ km}}$
↳ 3 s.f

b)



$\tan\theta = \frac{8}{26}$

$\tan^{-1}\left(\frac{8}{26}\right) = \underline{17.1°}$
↳ 3 s.f

6) a) $\overrightarrow{PR} = \overrightarrow{PQ} + \overrightarrow{QR}$

$240i - 600j + 450i + 350j = \underline{690i - 250j} \rightarrow \overrightarrow{PR}$

$|\overrightarrow{PR}| = \sqrt{(690)^2 + (-250)^2} = \underline{733.9\text{ m}}$
↳ 1 d.p

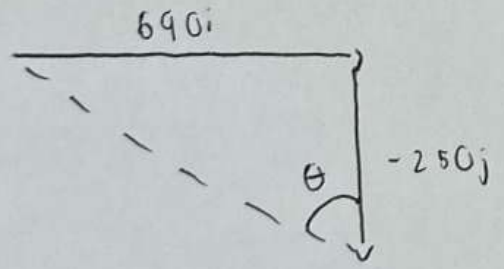
b) Total distance $= |\overrightarrow{PQ}| + |\overrightarrow{QR}|$

$= \sqrt{(240)^2 + (-600)^2} + \sqrt{(450)^2 + (350)^2}$

$= 1216.307489$

↳ $\underline{1216\text{ m}}$

c)



$\tan\theta = \frac{690}{250}$

$\tan^{-1}\left(\frac{690}{250}\right) = 70.083$
↳ $\underline{70.1°}$
↳ 3 s.f

$180 - 70.1 = \underline{109.9°}$
↳ 4 s.f