Resolving Non-Perpendicular Forces at a Point (From OCR 4728)

Q1, (Jan 2007, Q2)

(i)		M1		For resolving forces vertically
	15 x 0.28 and 11x 0.8	A1		Allow use of = 16.3 and =53.1
	Y= 15x0.28 + 11x0.8 - 13	A1ft		Ft cv(15 x 0.28 and 11x 0.8)
	Component is zero AG	A1	4	**SR** 15sin + 11sin -13 = 0 gets M1A0A1ftA0
(ii)		M1		For resolving forces horizontally
	X = 15 x 0.96 – 11 x 0.6	A1		Allow use of = 16.3 and =53.1
	Magnitude is 7.8N	A1	3	Accept 7.79, -7.8
(iii)	Direction is that of the (+ve) x -axis	B1	1	Do not allow horizontal, 90° from vertical. Do not award if = 16.3 and =53.1 have been used.

Q2, (Jan 2009, Q3)

(i)	5cos30 or 5 sin 60 or 4.33 5cos 60 or 5sin30 or 2.5	B1 B1 [2]	Order immaterial, accept +/-. May be awarded in (ii) if no attempt in (i)
(ii)	 7-4.33 (= 2.67) and 9 - 2.5 (= 6.5) $R^2 = 2.67^2 + 6.5^2$ R = 7.03 tanθ = 6.5/2.67 θ = 67.6, 67.7degrees	M1* A1 D*M1 A1 D*M1 A1 [6]	Subtracts either component from either force 3sf or better Valid trig for correct angle 3sf or better

Q3, (Jun 2010, Q3)

i	H = +/-(9 - 5cos60) H = 6.5 N	 AG	M1 A1 [2]	+/-(9 + 5cos120)
ii	V = +/-(12 - 5sin60) V = 7.67 N		M1 A1 [2]	+/-(12 + 5cos150) Accept 7.666 or better, or 7.6 recurring
iii	$R^2 = 6.5^2 + 7.67^2$ R = 10.1 N tan A = 6.5/7.67 or 7.67/6.5 A = 40(.3) or 49.7 Bearing = 320°		M1 A1 M1 A1 A1 [5]	Uses Pythagoras on forces V(ii) and 6.5 10.053.. Uses trigonometry in relevant triangle May be implied by final answer As this is not a final answer, exact accuracy is not an issue Or better

Q4, (Jun 2012, Q1)

(i)		$F^2 = 17^2 - 8^2$ $F = 15$ $\cos\alpha = 8/17$ $\alpha = 61.9°$	M1 A1 M1 A1 **[4]**	$F^2 = 17^2 +/- 8^2$ Exact accept 15.0 Correct method for angle between 8 N and 17 N forces Accept 62° from correct work
(ii)		$E = 17$ Angle = 118(.1)° OR 242° (241.9°)	B1 B1 FT **[2]**	Exact 180 – cv(α(**i**)) OR 180 +cv(a(**i**)) Must be 3sf or better

Q5, (Jun 2014, Q2)

(i)		$2.5\sin\theta = 2.4$ $\theta = 73.7$ $2.5\cos\theta = F$ $F = 0.7$ *OR* $2.4^2+F^2=2.5^2$ *or* $F^2=2.5^2-2.4^2$ $F = 0.7$	M1 A1 M1 A1 [4] M1 A1	2.5CorSθ = 2.4 Accept 74 F = 2.5 SorCθ, opposite to that above Exact, but allow 0.702 (3 sf) $\theta = 73.7$	$2.5\cos\theta = 2.4$ M1 hence $\theta = 16.3$ A0 $2.5\sin\theta = F$ M1 hence F =0.7(00) A1 SC F can then be used to find θ
(ii)		$2.4 = 0.2a$ $a = 12$ ms^{-2} Bearing (0)90° *OR* "To right"," opposite old 2.4 N force" etc	M1 A1 B1 [3]	N2L, Any horizontal force other than F, 0.7, 2.5 (Do not treat removing/using 2.5 as a MR) 12.0 from 2.5sin73.7 /0.2 Angle value other than exactly 90° or 0° B0 Allow B1 for force dirn, if accn not found	Including g, automatically M0 Horizontal is B0 (ambiguous)

Q6, (Jun 2015, Q4)

(i)		$x = +/-(10 - 6\cos 70)$, $y = 6\sin 70$ *OR* $+/-(10\cos 70 - 6)$, $10\sin 70$ *OR* correct resolving in 2 perpendicular directions $R^2 = \{+/-(10 - 6\cos 70)\}^2 + (6\sin 70)^2 = \{+/-(10\cos 70 - 6)\}^2 + (10\sin 70)^2$ $R = 9.74$ N Tan$\alpha = (6\cos 20)/(10 - 6\sin 20)$ $\alpha = 35.4°$	B1,B1 M1 A1 M1 A1 **[6]**	$10\cos 55 + 6\cos 55$ (= 9.177) B1 $+/-(10\sin 55 - 6\sin 55)$ (= +/–3.2766) B1 $R^2 = (10\cos 55 + 6\cos 55)^2 + (10\sin 55 - 6\sin 55)^2$ $R = 9.74$ N www	Uses cosine rule M1 $R^2 = 6^2 + 10^2 - 2 \times 6 \times 10 \cos$ B1 Uses angle of 70 B1 R = 9.74 N A1 Sinα /6 = sin70/9.744 M1 $\alpha = 35.4°$ A1
(ii)		Force = (20 – 9.74) = 10.3 N	B1ft **[1]**	Difference of weight and Resultant ft 20 – cv(9.74)	
(iii)		Tan$\theta = +/-(10 - 6\cos 70)/6\sin 70$ *OR* Tan$\varphi = +/-(6\sin 70)/(10 - 6\cos 70)$ Angle = 54.6°	M1 A1 **[2]**	Uses resultant is vertical	Angle = 90 – cv(35.4) M1 Angle = 54.6° A1