

Year 1 Applied Chapter: Forces and Motion – Vectors
Exam Questions (Answers)

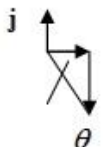
Q1.

(a)	$\mathbf{F}_2 = k\mathbf{i} + k\mathbf{j}$ $(-1+a)\mathbf{i} + (2+b)\mathbf{j}$ $\frac{-1+a}{2+b} = \frac{1}{3}$ $a = b = k = 2.5; \mathbf{F}_2 = 2.5\mathbf{i} + 2.5\mathbf{j}$ ALTERNATIVE: $\mathbf{F}_2 = k\mathbf{i} + k\mathbf{j}$ $(-1+a)\mathbf{i} + (2+b)\mathbf{j} = p(\mathbf{i} + 3\mathbf{j})$ $-1+a = p$ $2+b = 3p$ $a = b = k = 2.5; \mathbf{F}_2 = 2.5\mathbf{i} + 2.5\mathbf{j}$	B1 M1 DM1 A1 DM1 A1; A1 (7) B1 M1 for LHS DM1 A1 DM1 A1; A1 (7)
(b)	$\mathbf{v} = 3\mathbf{i} - 22\mathbf{j} + 3(3\mathbf{i} + 9\mathbf{j})$ $= 12\mathbf{i} + 5\mathbf{j}$ $ \mathbf{v} = \sqrt{12^2 + 5^2} = 13 \text{ ms}^{-1}$	M1 A1 M1 A1 cso (4)

Q2.

Question Number	Scheme	Marks
(a)	$(4\mathbf{i} - 2\mathbf{j}) + (2\mathbf{i} + q\mathbf{j}) = (6\mathbf{i} + (q-2)\mathbf{j})$ $6 = 2(q-2)$ $q = 5$ ratio 2:1	M1A1 DM1 A1 (4)
(b)	$6\mathbf{i} + 3\mathbf{j} = 1.5\mathbf{a}$ $\mathbf{a} = (4\mathbf{i} + 2\mathbf{j}) \text{ m s}^{-2}$ $\mathbf{v} = \mathbf{u} + \mathbf{at} = (-2\mathbf{i} + 4\mathbf{j}) + 2(4\mathbf{i} + 2\mathbf{j})$ $= 6\mathbf{i} + 8\mathbf{j}$ $\text{speed} = \sqrt{6^2 + 8^2}$ $= 10 \text{ m s}^{-1}$	M1 A1 M1 A1ft M1 A1 (6) [10]

Q3.

Question Number	Scheme	Marks
(a)	 $\tan \theta = \frac{2}{1} \Rightarrow \theta = 63.4^\circ$ angle is 153.4°	M1 A1 A1 (3)
(b)	$(4 + p)\mathbf{i} + (q - 5)\mathbf{j}$ $(q - 5) = -2(4 + p)$ $2p + q + 3 = 0 *$	B1 M1 A1 A1 (4)
(c)	$q = 1 \Rightarrow p = -2$ $\Rightarrow \mathbf{R} = 2\mathbf{i} - 4\mathbf{j}$ $\Rightarrow \mathbf{R} = \sqrt{2^2 + (-4)^2} = \sqrt{20}$ $\sqrt{20} = m8\sqrt{5}$ $\Rightarrow m = \frac{1}{4}$	B1 M1 M1 A1 f.t. M1 A1 f.t. A1 cao (7) [14]

Q4.

Question Number	Scheme	Marks
(a)	$\tan \theta = \frac{p}{2p} \Rightarrow \theta = 26.6^\circ$	M1 A1 (2)
(b)	$\mathbf{R} = (\mathbf{i} - 3\mathbf{j}) + (p\mathbf{i} + 2p\mathbf{j}) = (1 + p)\mathbf{i} + (-3 + 2p)\mathbf{j}$ $\mathbf{R}$ is parallel to $\mathbf{i} \Rightarrow (-3 + 2p) = 0$ $\Rightarrow p = \frac{3}{2}$	M1 A1 DM1 A1 (4) [6]