1 **(a** 1. no resultant force acts / no net force acts
OR total force up / in any direction = total force down / in opposite direction B1
allow sum of forces or resultant force for total force

2. no resultant moment / couple / torque acts
OR (sum of) clockwise moments and (sum of) anti-clockwise moments (about any point / axis) balance B1

(b) (anti-clockwise moment =) $F \times 2$ C1
(total clockwise moment =) $(120 \times 33) + (20 \times 15) = 4260$ (N cm)
2130 N A1

(ii) 1990 N OR candidate's **(b)(i)** – 140 N B
force is downwards B1 [7]

2 **(a)** vector has direction OR scalar has no direction/only has size B1

(ii) any appropriate example B1

(b) NOTE: accept diagram in any orientation;
triangle or rectangle with hypotenuse/diagonal of
length ½ that of one side B1
100, 200 and *T* all correctly labelled B1
value in range 165 N – 180 N inclusive B1 [5]

3 **(a** 2nd statement re-written to include force in first gap and inversely proportional to mass in second gap. NOT indirectly proportional B1

(b) F = ma OR in words in any correct arrangement B1

(c) **(i)** nothing OR continues as before OR same / constant velocity OR same / constant speed & direction OR no acceleration B1

(ii) idea of retardation. Ignore stop. Ignore brakes. Ignore goes in opposite direction B1

(iii) moves in (arc of a) circle or curve OR deflected OR turns OR changes direction B1 [5]

4 **(a** Mark **(i)** and **(ii)** together. Note <u>both</u> M1s required to score the A1 mark

(i) B M1

(ii) idea of greater / different (NOT less) increase in length for each additional load
accept load not proportional to extension or reverse argument M1

at 4th or 5th reading / value between 2.0 – 2.5 N / 11.6 – 12.6 cm A1

(b) (i) 1.0 cm B1

(ii) 5.7 cm B1

(c) 2.5 (cm) OR 1.25 (N) OR 5.0(cm) ignore 2.5N e.c.f. from **(b)** if clear C1
8.2 cm e.c.f. from **(b)** if clear <u>A1</u>
e.g. 10.7/2 (= 5.35) scores 0 [7]

5 **(a** (parallelogram or triangle may have any orientation)
NOT a copy of Fig. 1.1
two sides at right angles, by eye B1
one side longer than the other B1
diagonal or completion of triangle drawn **and** labelled "resultant" OR R
Ignore numerical values. Condone arrows in wrong direction B1

(b) 98 N – 102 N B1
(accept value found by calculation)

(c) (vertically) up/opposite to W NOT North B1

(d) his **(b)** OR correct value calculated B1
ignore mass

[Total: 6]

6 **(a** constant velocity must be in a straight line/direction of motion is changing B1

(b) if no force, then constant velocity in straight line OR force is needed to change direction B1

body moving in circle is changing direction/velocity/accelerating so force is needed B1

(ii) towards centre (of circle)/at right angles to motion/inwards B1

(iii) friction between tyres and road/reaction from banking of track B1

[Total: 5]

7 **(a (i)** 120 Ncm OR 1.2 Nm B1

(ii) 60 Ncm OR 0.6 Nm B1

(iii) idea of CW moments = ACW moments C1
$60 + 20F = 120$ OR $0.6 + 0.2F = 1.2$ e.c.f. C1
3.0 N OR 3 N e.c.f. A1

(b) $1.2 \times 20 = 2.0 \times d$ OR $1.2 \times 0.2 = 2.0 \times d$ C1
(d =) 12 OR 0.12 C1
18 c.a.o. OR special case (30 – his 12) correctly evaluated B1 A1

[Total: 8]