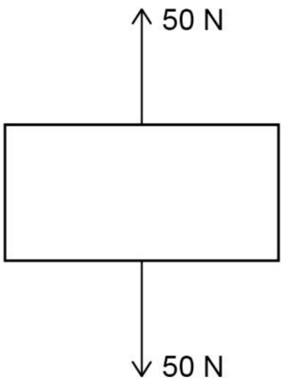
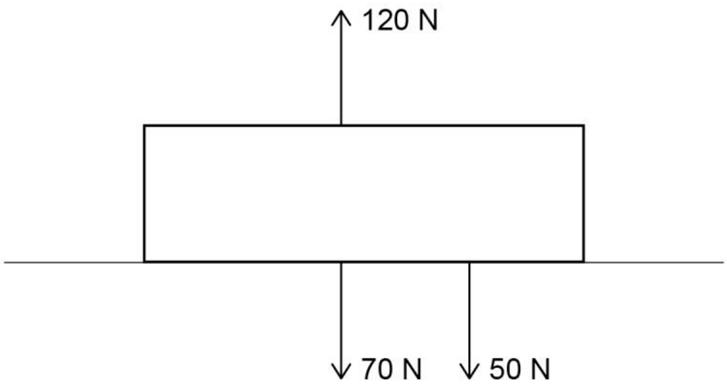
TOPIC TEST
MARK SCHEME

AS and A-level MATHS

Forces 2

Mark scheme

Specification content coverage: R4

Question	Solutions	Mark
1 (a)	11**i** – 8**j**	1
1 (b)	–11**i** + 8**j**	1
2 (a)		1
2 (b)		1 mark for upward force correct 1 mark for both downward forces correct
3 (a)	$R - 70g = 70 \times 4$ R = 966 = 970 N (2 significant figures)	1 1
3 (b)	$70g - R = 70 \times 6$ R = 266 = 270 N (2 significant figures)	1 1
4 (a)	$5g - T_1 = 5 \times 1.96$ T_1 = 39.2 = 39 N (2 significant figures)	1 1
4 (b)	$T_1 - T_2 = 8 \times 1.96$ T_2 = 23.52 = 24 N (2 sf)	1 1

4 (c)	$mg - T_2 = m \times 1.96$ $m = 3$ kg	1 1
5 (a)	Resolve on whole system $18\,550 - (300 + 150 + 100) = 12m \times 2.5$ $m = 600$	 1 1
5 (b)	Resolve on one truck or on engine $18550 - T_1 - 300 = 3000 \times 2.5$ or $T_2 - 100 = 1800 \times 2.5$ or $T_1 - T_2 - 150 = 2400 \times 2.5$ $T_1 = 10\,750$ N $T_2 = 4600$ N	 1 1 1
6	Resolve horizontally on 9 kg box $T = 9a$ Resolve vertically on 3 kg box $3g - T = 3a$ $a = 2.45 = 2.5$ m s^{-2} (2 significant figures) $T = 22.05 = 22$ N (2 significant figures) $3 = 0 + 0.5 \times 2.45t^2$ $t = 1.56 = 1.6$ s (2 significant figures)	 1 1 1 1 1 1
7	Resolve vertically on 6 kg particle $6g - T = 6a$ Resolve vertically on 3 kg box $T - 3g = 3a$ $a = 3.27$ velocity when 6 kg hits the floor $v^2 = 2 \times 3.27 \times 2$ $v^2 = 13.08$ ($v = 3.6166\ldots$) Either: further distance travelled when 3 kg particle reaches greatest height, $v = 0$ $0 = 13.08 - 2 \times 9.81 \times s$ $s = \frac{2}{3}$ m No, because the particle will still be $5 - 2 - 2 - \frac{2}{3} = \frac{1}{3}$ m below the pulley Or: velocity of 3 kg particle when it reaches the pulley, $s = 1$ $v^2 = 13.08 - 2 \times 9.81 \times 1$ No, because $v^2 = -6.54$ m s^{-1}, which shows it cannot reach the pulley	 1 1 1 1 1 1 1