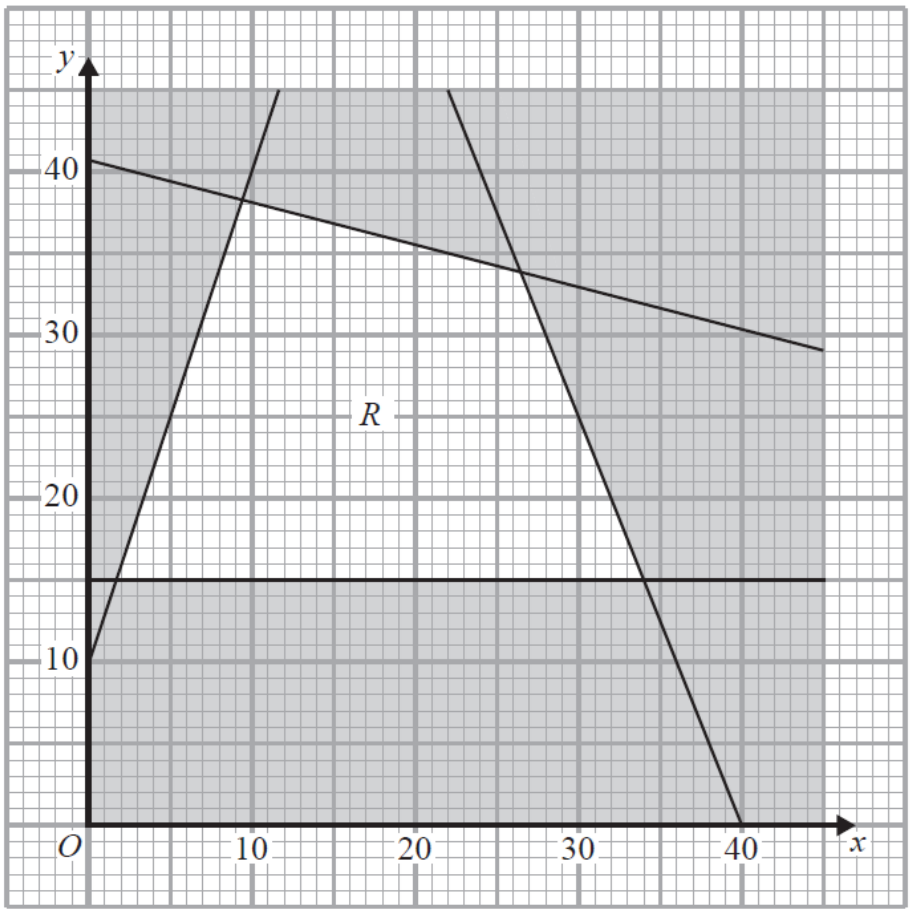
Question Number	Scheme	Marks
8. (a)		B1 B1 B1 **(3)**
(b)	<table><tr><td></td><td></td><td>Vertex</td><td>Value</td></tr><tr><td>$y \leqslant 3x + 10$</td><td>$y \geqslant 15$</td><td>$\left(\frac{5}{3}, 15\right)$</td><td>85</td></tr><tr><td>$y \leqslant 3x + 10$</td><td>$x + 4y \leqslant 162$</td><td>$\left(\frac{122}{13}, \frac{496}{13}\right)$</td><td>$\frac{3212}{13} = 247\frac{1}{13}$</td></tr><tr><td>$x + 4y \leqslant 162$</td><td>$5x + 2y \leqslant 200$</td><td>$\left(\frac{238}{9}, \frac{305}{9}\right)$</td><td>$\frac{2953}{9} = 328\frac{1}{9}$</td></tr><tr><td>$5x + 2y \leqslant 200$</td><td>$y \geqslant 15$</td><td>$(34, 15)$</td><td>279</td></tr></table> Optimal vertex is $\left(\frac{238}{9}, \frac{305}{9}\right)$	M1 A1 A1 A1 **(4)**

(c)		
		dM1
		A1
		A1
		(3)
(d)	Considers limiting cases $P = kx + y$ parallel to $x + 4y = 162$ and $5x + 2y = 200$	M1
	$\frac{1}{4} < k < \frac{5}{2}$	A1
		(2)
		12 marks

	Notes for Question 8	
a1B1	Two lines correctly drawn $y = 15$ should pass through two points of the form (…, 15) $y = 3x+10$ must pass through (0, 10) and (10, 40) $5x+2y = 200$ must pass through (24, 40) and (32, 20) Lines should pass within one small square of these points.	
a2B1	All three lines correct	
a3B1	All lines correct and feasible region labelled with *R*.	
b1M1	Attempts to solve at least 3 pairs of simultaneous equations to find the coordinates of vertices (may be implied by three correct coordinate pairs)	
b1A1	2 pairs of coordinates (excluding $\left(\frac{5}{3}, 15\right)$) and their corresponding values of objective function correct (accept decimal equivalents to at least 1 decimal place)	
b2A1	All 3 pairs of coordinates (excluding $\left(\frac{5}{3}, 15\right)$) and their corresponding values of objective function correct (accept decimal equivalents to at least 1 decimal place)	
b3A1	Optimal vertex stated or clearly identified (must be exact coordinates)	

$x + 4y \leqslant 162$	$5x + 2y \leqslant 200$	Y/N	Value
26, 33	158	196	Y	321
26, 34	162	198	Y	326
27, 33	159	201	N	
27, 34	163	203	N	

Optimal solution is $x = 26$, $y = 34$ value 326

c1dM1	Dependent on obtaining an optimal vertex from a choice of at least two vertices considered in (b); in part (b) there must be working, even if incorrect, leading to identifying an optimal vertex. Considers integer solutions around their optimal point (at least 3 integer points considered). We need to see them engage with the values, not just list points around their optimal point (e.g. a rectangle with vertices labelled is not sufficient). We want to see at minimum a calculation or values embedded in the objective function for these vertices.	
c1A1	Three points correct ((27, 34) not required) – i.e the two feasible integer solutions with correct values, and a rejection of one of the coordinate(s) outside the feasible region. Accept if (27, 33) is not used at any point in calculations – we can accept this as implicit rejection of this point.	
c2A1	CAO Correct integer coordinate stated with correct value for the objective function. Accept the coordinate given in the form $x = \ldots$, $y = \ldots$ Must score the previous A mark.	
d1M1	Considers limiting cases – may be implied by correct answer. Note that **both** limiting cases must be considered; e.g. reaching $k < \frac{5}{2}$ only is M0. **Alt Method for d):** Some candidates might consider the value of the objective function at the vertices $\left(\frac{122}{13}, \frac{496}{13}\right), \left(\frac{238}{9}, \frac{305}{9}\right)$ and $(34, 15)$ M1: **Both** of the following inequalities considered: $\frac{238}{9}x + \frac{305}{9} > \frac{122}{13}x + \frac{496}{13}$ **and** $\frac{238}{9}x + \frac{305}{9} > 34x + 15$	
d1A1	CAO (Condone non-strict inequalities)	