

# Mark Scheme (Results) January 2010

GCE

Decision Mathematics D1 (6689)

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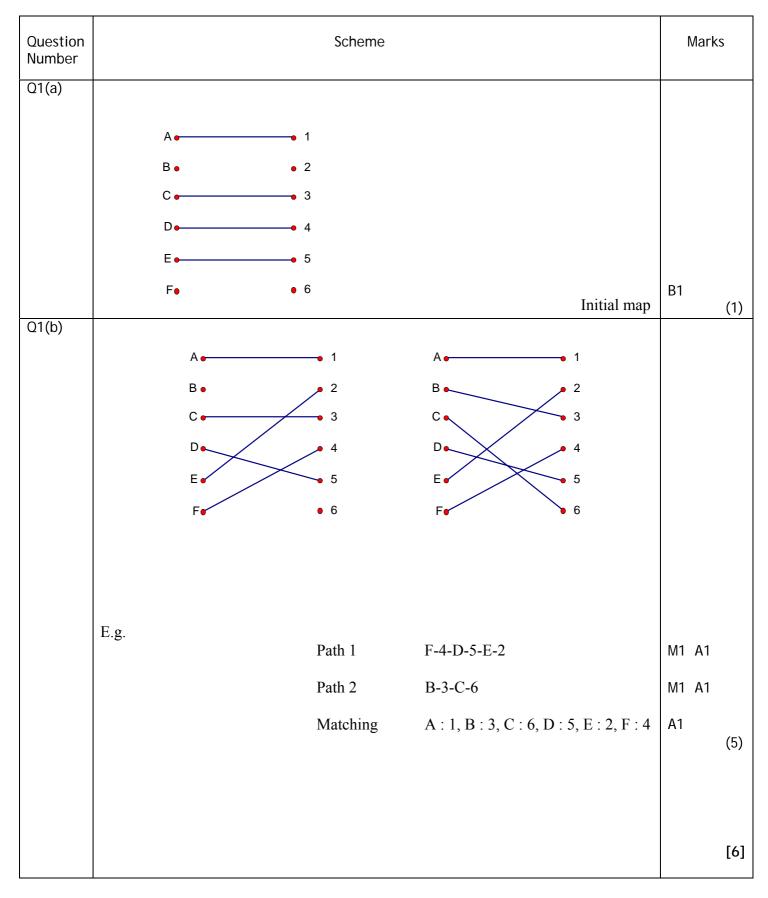
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## January 2010 6689 Decision Mathematics D1 Mark Scheme



uestion Imber		Scheme								Mark	
l (b)											
	Question 1(b) Alternative Solutions										
	Dut to Matching										
		Path 1	Path 2	Α	В	С	D	<u> </u>	F		
	1	B-3-C-1-A-2	F-3-B-4-D-5-E-1-C-6	2	4	6	5	1	3		
	2	B-3-C-1-A-2	F-3-B-4-D-5-E-2-A-1-C-6	1	4	6	5	2	3		
	3	B-3-C-1-A-2	F-4-D-5-E-1-C-6	2	3	6	5	1	4		
	4	B-3-C-1-A-2	F-4-D-5-E-2-A-1-C-6	1	3	6	5	2	4		
	5	B-3-C-4-D-5-E-1-A-2	F-3-B-4-C-6	2	4	6	5	1	3		
	6	B-3-C-4-D-5-E-1-A-2	F-4-C-6	2	3	6	5	1	4		
	7	B-3-C-6	F-3-B-4-D-5-E-1-A-2	2	4	6	5	1	3		
	8	B-3-C-6	F-3-B-4-D-5-E-2	1	4	6	5	2	3		
	9	B-3-C-6	F-4-D-5-E-1-A-2	2	3	6	5	1	4		
	10	B-3-C-6	F-4-D-5-E-2	1	3	6	5	2	4		
	11	B-4-D-5-E-2	F-3-C-6	1	4	6	5	2	3		
	12	B-4-D-5-E-2	F-4-B-3-C-6	1	3	6	5	2	4		
	13	B-4-D-5-E-1-A-2	F-3-C-6	2	4	6	5	1	3		
	14	B-4-D-5-E-1-A-2	F-4-B-3-C-6	2	3	6	5	1	4		
	15	F-3-C-1-A-2	B-3-F-4-D-5-E-1-C-6	2	3	6	5	1	4		
	16	F-3-C-1-A-2	B-3-F-4-D-5-E-2-A-1-C-6	1	3	6	5	2	4		
	17	F-3-C-1-A-2	B-4-D-5-E-1-C-6	2	4	6	5	1	3		
	18	F-3-C-1-A-2	B-4-D-5-E-2-A-1-C-6	1	4	6	5	2	3		
	19	F-3-C-4-D-5-E-1-A-2	B-3-F-4-C-6	2	3	6	5	1	4		
	20	F-3-C-4-D-5-E-1-A-2	B-4-C-6	2	4	6	5	1	3		
	21	F-3-C-6	B-3-F-4-D-5-E-1-A-2	2	3	6	5	1	4		
	22	F-3-C-6	B-3-F-4-D-5-E-2	1	3	6	5	2	4		
	23	F-3-C-6	B-4-D-5-E-1-A-2	2	4	6	5	1	3		
	24	F-3-C-6	В-4-D-5-Е-2	1	4	6	5	2	3		
	25	F-4-D-5-E-2	B-3-C-6	1	3	6	5	2	4		
	26	F-4-D-5-E-2	B-4-F-3-C-6	1	4	6	5	2	3		
	27	F-4-D-5-E-1-A-2	B-3-C-6	2	3	6	5	1	4		
	28	F-4-D-5-E-1-A-2	B-4-F-3-C-6	2	4	6	5	1	3		

- (a) B1 cao preferably just 4 lines, but accept if unambiguous.
- (b) M1 attempt at a path from B or F to 2 or 6
  - A1 correct path including change status
    - M1 attempt at a second path from F or B to 6 or 2
    - A1 correct path including change status (do not penalise change status twice)
    - A1 correct matching; must follow from 2 correct paths

Question Number	Scheme	Marks	
Q2(a)	<ul> <li>(i) All pairs of vertices connected by a path, but not describing complete graph.</li> <li>(ii) No cycles</li> <li>(iii) All nodes connected (accept definition of minimum spanning tree)</li> </ul>	B1 B1 B1	(3)
Q2(b)	Kruskal's (algorithm)	B1	(1)
Q2(c)(i)	L-O 56 L-C 60 C-N 62 O-S 63 S-P 43 C-Y 156 Total length 440 (miles) Using Prim. first 2 correct Next 2 Finish Total	M1 A1 A1 A1 =B1	
Q2(c)(ii)	Tree correct	B1	(5)
	P		[9]

#### Q2(c)

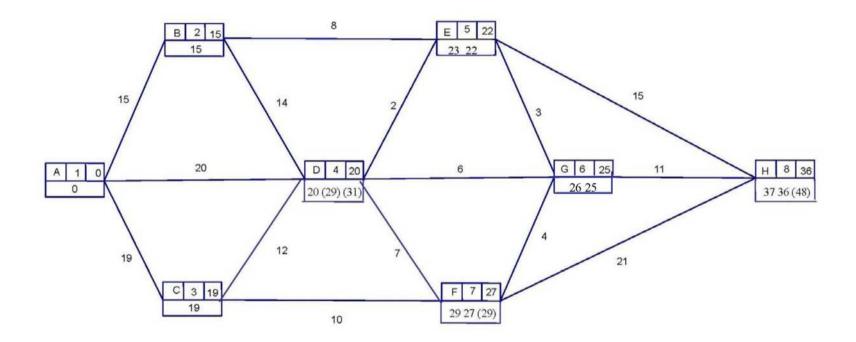
Accept weights as indicating arcs.

#### Misreads - award M1 A0 A0 for these:

- Vertices, not edges given L O C N S P Y
- Numbers across top, edges either incorrect or not given: 3 1 4 2 6 5 7.

#### Also accept these, misreading And not starting at L - again M1A0A0

Started at	Minimum arcs	nodes	Numbers
С	CL,LO,CN,	CLONSPY	1243657
Ν	NC,CL,LO,OS,SP,CY	NCLOSPY	2314657
0	OL,LC,CN,OS,	OLCNSPY	3241657
Р	PS,SO,OL,LC,CN.CY	PSOLCNY	5463127
S	SP.SO,	SPOLCNY	5463217
Υ	YC,CL,LO,CN,	YCLONSP	2354761



Clear method to include at least 1	update
(look at E, F, G or H)	M1
BCDE correct	Al
FGH correct	Alft
Route ADEGH	A1
Total time 36 Minutes	A1ft (5)

Marks
M1
A1
A1
A1
A1ft (5)
[10]

Question Number					Sc	heme						M	larks
Q4(a)	0.6	4.0	2.5	3.2	0.5	2.6	0.4	0.3	4.0	1.0	2.6		
	4.0	3.2	4.0	<u>2.6</u>	0.6	2.5	0.5	0.4	0.3	1.0	3.2 0.4	M1	
	4.0	4.0	<u>3.2</u>	2.6	0.6	2.5	0.5	1.0	0.4	0.3	4.0 0.5	A1	
	4.0	<u>4.0</u>	<u>3.2</u>	<u>2.6</u>	0.6	2.5	1.0	<u>0.5</u>	<u>0.4</u>	<u>0.3</u>	2.5	A1ft	
	<u>4.0</u>	$\frac{4.0}{4.0}$ $\frac{4.0}{4.0}$	<u>3.2</u>	2.6	<u>2.5</u>	0.6	1.0	0.5	$\frac{0.4}{0.4}$	0.3	1.0	A1ft	
	<u>4.0</u>	<u>4.0</u>	<u>3.2</u> <u>3.2</u> <u>3.2</u>	2.6 2.6 2.6	<u>2.5</u> <u>2.5</u>	<u>1.0</u>	0.6	<u>0.5</u>	<u>0.4</u>	$\frac{0.3}{0.3}$ $\frac{0.3}{0.3}$		A1 c	:so (5)
Q4(b)			ength 1: ength 2:										
		L	ength 3:	3.2	0.6			left col	umn & I	1.0 in plac	e	M1	
			ength 4:		1.0	0.4				0.6 & 0.5		A1	
		L	ength 5:	2.5	0.5	0.3				0.4		A1	
										All correc	et (c.s.o)	A1	
0.1()	10.11								2	<i></i>			(4)
Q4(c)	19.1/4	4 = 4.77		•	,	1		,		0.9 'spar		B1	
			Yes, t	he answ	ver to (t	b) does u	ise the n	nınımur	n numbe	er of bins.		DB1	(0)
													(2)
													[11]

#### Notes for Q4(a)

1M1 Pivot, p, chosen. List sorted, >p, p. p. If only choosing 1 pivot per iteration M1 only

1A1  $1^{st}$  pass correct and chosen next **two** pivots correctly for sublists >1

2A1ft  $2^{nd}$  pass correct and chosen next **two** pivots correctly for sublists >1

3A1ft  $3^{rd}$  pass correct and next pivot for sublist >1 chosen correctly.

4A1 cso.

#### Misread in part (a)

- If they have misread a number **at the start of part (a), so genuinely miscopied** and got for example 0.1 instead of 1.0 then mark the whole question as a misread removing the last two A or B marks earned. This gives a maximum total of 9.
- If they misread their own numbers **during the course of part (a)** then count it as an **error in part (a)** but mark parts (b) and (c) as a misread. So they would lose marks in (a) for the error and then the last two A or B marks earned in (b) and (c) giving a maximum of 8 or maybe 7 marks depending on how many marks they lose in (a).

The most popular misread is the one listed above – where 1.0 has changed to 0.1 giving

4.0 4.0 3.2 2.6 2.5 0.6 0.5 0.4 0.3 **0.1** at the end of (a) for this one (b) and (c) are:

(b) Length 1: 4
Length 2: 4
Length 3: 3.2 0.6 0.1
Length 4: 2.6 0.5 0.4 0.3
Length 5: 2.5

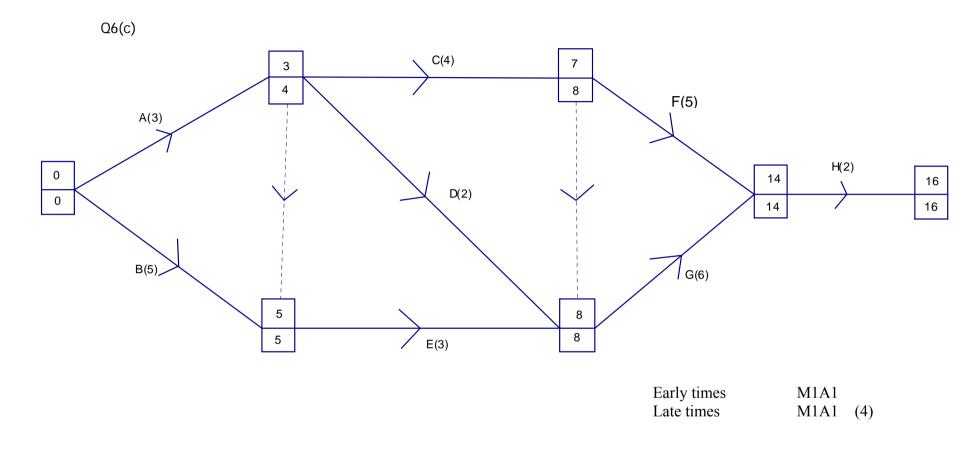
(c) 18.2/4 = 4.55 so 5 bins, or total is 18.2 or 1.8 'spare' Yes answer in (b) uses the minimum number of bins. Alternate solutions for Question 4

ſ

Choo: 0.6 <u>4.0</u> <b>4.0</b> <b>4.0</b> <b>4.0</b>	sing mid 4.0 4.0 <u>4.0</u> <u>4.0</u> <b>4.0</b> <b>4.0</b>	ddle lef 2.5 2.5 <b>3.2</b> <b>3.2</b> <b>3.2</b> <b>3.2</b> <b>3.2</b>	it 3.2 3.2 0.6 2.6 <b>2.6</b> <b>2.6</b> <b>2.6</b>	0.5 2.6 2.5 <b>2.5</b> <b>2.5</b> <b>2.5</b> <b>2.5</b>	2.6 4.0 2.6 <u>0.6</u> <u>1.0</u> <b>1.0</b>	0.4 1.0 1.0 1.0 <b>0.6</b> <b>0.6</b>	0.3 0.5 0.5 0.5 0.5 0.5	4.0 <u>0.4</u> <b>0.4</b> <b>0.4</b> <b>0.4</b> <b>0.4</b>	1.0 0.3 <u>0.3</u> <b>0.3</b> <b>0.3</b> <b>0.3</b>	(pivot 0.5) (pivots 3.2, 0.4) (pivots 4.0, 2.5) (pivots 0.6)
Choo: <u>0.6</u> <u>4.0</u> <b>4.0</b> <b>4.0</b> <b>4.0</b> <b>4.0</b> <b>4.0</b>	sing firs 4.0 2.5 <u>2.5 3.2</u> <u>4.0</u> <b>4.0</b>	st 2.5 3.2 3.2 2.6 <b>3.2</b> <b>3.2</b> <b>3.2</b> <b>3.2</b>	3.2 2.6 2.6 4.0 <u>2.6</u> <b>2.6</b>	0.5 4.0 4.0 <b>2.5</b> <b>2.5</b> <b>2.5</b>	2.6 1.0 1.0 <u>1.0</u> <b>1.0</b> <b>1.0</b>	0.4 0.6 0.6 0.6 0.6 0.6	0.3 <u>0.5</u> <b>0.5</b> <b>0.5</b> <b>0.5</b> <b>0.5</b>	4.0 0.4 <u>0.4</u> <b>0.4</b> <b>0.4</b> <b>0.4</b>	1.0 0.3 0.3 <u>0.3</u> <b>0.3</b> <b>0.3</b>	(pivot 0.6) (pivots 4.0, 0.5) (pivots 2.5, 0.4) (pivots 3.2)
0.6 4.0 4.0 4.0 4.0 4.0 4.0	4.0 2.5 4.0 4.0 4.0 4.0	2.5 3.2 <u>2.5</u> <u>3.2</u> <b>3.2</b> <b>3.2</b> <b>3.2</b>	sing firs 3.2 2.6 3.2 2.6 <u>2.6</u> <b>2.6</b> <b>2.6</b> <b>2.6</b>	0.5 4.0 2.6 <b>2.5</b> <b>2.5</b> <b>2.5</b>	2.6 1.0 1.0 <u>1.0</u> <b>1.0</b> <b>1.0</b>	0.4 0.6 0.6 0.6 0.6 0.6	0.3 <u>0.5</u> <b>0.5</b> <b>0.5</b> <b>0.5</b> <b>0.5</b> <b>0.5</b>	4.0 0.4 <u>0.4</u> <b>0.4</b> <b>0.4</b> <b>0.4</b> <b>0.4</b>	1.0 0.3 0.3 <b>0.3</b> <b>0.3</b> <b>0.3</b>	(pivot 0.6) (pivots 4.0, 0.5) (pivots 2.5, 0.4) (pivots 3.2) ed, otherwise MISREAD)
Middl 0.6 <u>0.4</u> <u>0.3</u> 0.3 0.3		2.5 0.5 0.5 0.5 0.5 0.5 0.5	3.2 0.6 0.6 <u>0.6</u> <b>0.6</b>	<u>0.5</u> 4.0 <u>2.5</u> 1.0 1.0	2.6 2.5 2.6 <b>2.5</b> <b>2.5</b> <b>2.5</b>	0.4 <u>3.2</u> 1.0 <u>2.6</u> <b>2.6</b>	0.3 2.6 <b>3.2</b> <b>3.2</b> <b>3.2</b> <b>3.2</b>	4.0 4.0 <u>4.0</u> <b>4.0</b> <b>4.0</b> <b>4.0</b> <b>4.0</b>	1.0 1.0 4.0 4.0 <b>4.0</b>	(pivot 0.5) (pivot 0.4, 3.2) (pivot 2.5, 4.0) (pivot 0.6)
Middl 0.6 0.3 <b>0.3</b> <b>0.3</b>	e right 4.0 2.5 0.4 0.4 0.4 0.4	2.5 0.5 0.6 <b>0.5</b> <b>0.5</b>	3.2 <u>0.4</u> 2.5 0.6 0.6	0.5 0.3 <u>0.5</u> <u>2.5</u> <u>1.0</u>	2.6 1.0 1.0 1.0 <b>2.5</b>	0.4 2.6 2.6 2.6 2.6	0.3 4.0 <b>3.2</b> <b>3.2</b> <b>3.2</b>	4.0 <u>3.2</u> 4.0 4.0 4.0	1.0 4.0 <u>4.0</u> <b>4.0</b> <b>4.0</b>	(pivot 2.6) (pivot 0.4, 3.2) (pivot 0.5, 4.0) (pivot 2.5) (pivot 1.0)
First <u>0.6</u> <u>0.5</u> <u>0.4</u> 0.3 <b>0.3</b> Eirot	4.0 0.4 0.3 <b>0.4</b> <b>0.4</b>	2.5 0.3 <b>0.5</b> <b>0.5</b>	3.2 0.6 0.6 0.6 0.6	0.5 <u>4.0</u> <u>2.5</u> 1.0 <b>1.0</b>	2.6 2.5 3.2 <b>2.5</b> <b>2.5</b>	0.4 3.2 2.6 <u>3.2</u> 2.6	0.3 2.6 1.0 2.6 <b>3.2</b>	4.0 4.0 <b>4.0</b> <b>4.0</b> <b>4.0</b>	1.0 1.0 4.0 <b>4.0</b> <b>4.0</b>	(pivot 0.6) (pivot 0.5, 4.0) (pivots 0.4, 2.5) (pivots 3.2)
<b>First</b> <u>0.6</u>	())									

Question Number		Scheme								
Q5	S	Т	R	R>0?	Output					
(a)	25000	0	17000	y	Output	Line 1				
(u)	20000	3400	17000	<u>y</u>		Line 2				
			7000			Line 3				
				y		Line 4				
	-	4450				Line 5				
			-5000			Line 6				
				n		Line 7				
					4450					
						Lines 1 & 2: Lines 3-7:	M1A1 M1A1			
						Output correct:	A1	(5)		
(b)	Tax on £	25 000 is £	E4450				B1ft	(1)		
(c)	Tax free	$sum = \pounds 80$	000:				B1	(1)		
								[7]		

Question Number		Marks				
Q6(a)	It is n	ty. A, but E depends on A and B.	B1 B1	(2)		
Q6(b)		Activity	Immediately preceding activity	]		
		А	-			
		В	-			
		С	А			
		D	А	To this point	B1	
		E	A,B			
		F	C (A)	For E & F, accepting correct "extra"	B1	
		G	C, D, E			
		Н	F, G	Last two rows, correct only,	B1	(3)

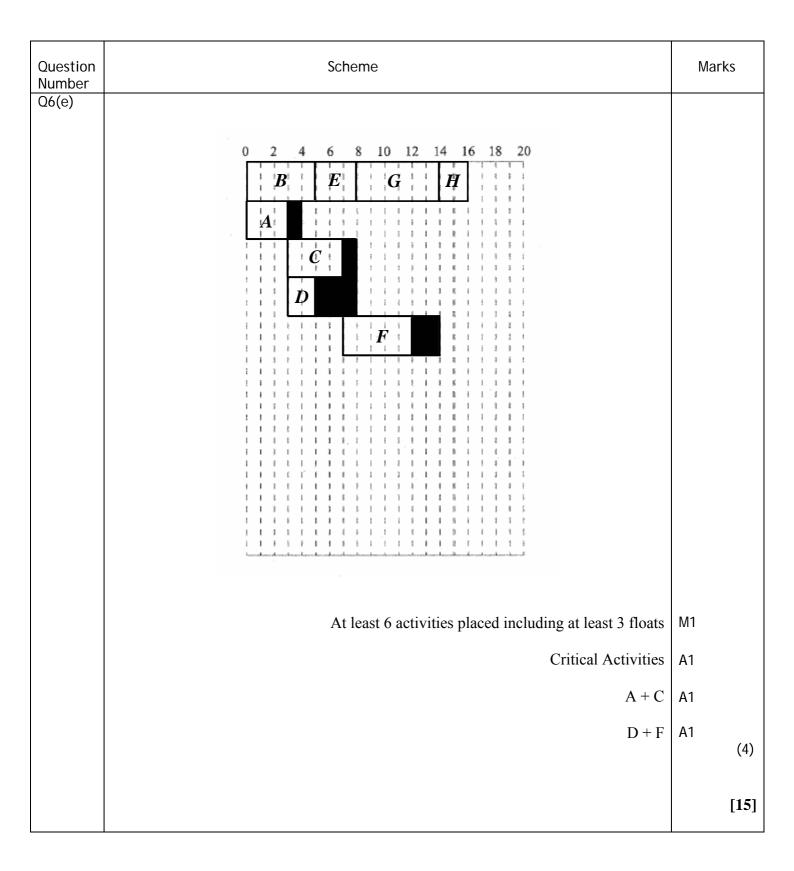


### Q6(d) Critical activities: B, E, G, H

B1

(2)

Critical path: 16 days B1ft



Question Number	Scheme	Mark	(S
Q7(a)	$x + 2y \le 12$ (150x + 300y $\le 1800$ )	M1A1	(2)
Q7(b)	$\begin{array}{r} 0.9x + 1.2y \leq 9 \\ \rightarrow 3x + 4y \leq 30  (*) \end{array}$	M1 A1 cso	(2)
Q7(c)	(You need to buy) at least 2 large cupboards.	B1	(1)
Q7(d)	Capacity C and 140%C So total is $Cx + \frac{140}{100}Cy$ Simplify to $7y + 5x$ (*)	M1 A1cso	(2)
Q7(e)	Graph:		
	$y \ge 2$ $0.9x + 1.2y \le 12$ $(3x + 4y \le 30)$ $x + 2y \le 12$ $(150x + 300y \le 1800)$ Lines labelled & drawn with a ruler	B1 B1 B1 B1	
	Shading, Region identified	B1, B1	(6)
Q7(f)	Consider points and value of $5x + 7y$ : Or draw a clear profit line	M1A1	
	$\begin{array}{rcl} (7,2) & \to & 49 \text{ or } (7 \frac{1}{3},2) & \to & 50 \frac{2}{3}, \text{ or } (7.3,2) \to 50.5 \\ (6,3) & \to & 51 \\ (0,6) & \to & 42 \end{array}$	A1	
	$(0,2) \rightarrow 14$ Best option is to buy 6 standard cupboards and 3 large cupboards.	A1	(4)
			(4) [17]

#### **Question 7 notes**

- (a) 1M1 correct terms, accept = here, accept swapped coefficients.
- 1A1 cao does not need to be simplified.
- (b) 1M1 correct terms, must deal with cm/m correctly, accept = here.
- 1A1 cso **answer given**.
- (c) 1B1 cao 'at least' and '2' and 'large'.
- (d) 1M1 '1.4' or '5 x 40%' maybe '5+2' seen, they **must** be **seen** to engage with 140% in some way.
  - 1A1 cso **answer given.**

#### Lines should be within 1 small square of correct point at axes.

- (e) 1B1 correctly drawing y = 2.
  - 2B1 correctly drawing 3x + 4y = 30 [0.9x + 1.2y = 12]
  - 3B1 correctly drawing x + 2y = 12 [150x + 300y = 1800], ft only if swapped coefficients in (a) (6,0)

(2,8).

# These next 3 marks are only available for candidates who have drawn at least 2 lines, including at least one 'diagonal' line with negative gradient.

- 4B1 Ruler used. At least 2 lines labelled including one 'diagonal' line.
- 5B1 Shading, or R correct, b.o.d. on their lines.
- 6B1 all lines and R correct.

(f) 1M1 At least 2 points tested **or** objective line drawn with correct m or 1/m, minimum intercepts 3.5 and

2.5.

- 1A1 2 points correctly tested **or** objective line correct.
- 2A1 3 points correctly tested or objective line correct and distinct/labelled.
- 3A1 6 standard and 3 large, accept (6,3) if very clearly selected in some way.

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