OCR
Oxford Cambridge and RSA

Thursday 21 October 2021 – Afternoon

A Level Further Mathematics A

Y544/01 Discrete Mathematics

Printed Answer Booklet

Time allowed: 1 hour 30 minutes

You must have:
- Question Paper Y544/01 (inside this document)
- the Formulae Booklet for A Level Further Mathematics A
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided in the **Printed Answer Booklet**. If you need extra space use the lined pages at the end of the Printed Answer Booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Give non-exact numerical answers correct to **3** significant figures unless a different degree of accuracy is specified in the question.
- The acceleration due to gravity is denoted by $g\,\mathrm{m\,s^{-2}}$. When a numerical value is needed use $g = 9.8$ unless a different value is specified in the question.

INFORMATION
- The total mark for this paper is **75**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

1(a)	Bag 1:
	Bag 2:
	Bag 3:
	Bag 4:
	Bag 5:
1(b)	
1(c)	

2(a)(i)

2(a)(ii)

2(b)

1.

2.

2(c)

	J	K	L	M	N
Indegree					
Outdegree					

2(d)(i)

2(d)(ii)

3(a)

3(b)

3(c)

3(d)

4(a)

Graph is not isomorphic to $K_{2,3}$

because

Graph is not isomorphic to $K_{2,3}$

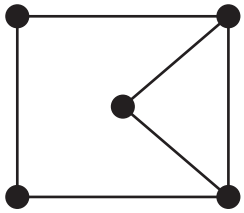
because

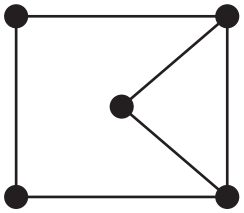
4(b)

4(c)

4(d)

SPARE COPY





4(e)

4(f)

4(g)

4(h)

5(a)

Beth

Alex		X	Y	Z
	P	x	3	2
	Q	4	0	−2
	R	−3	−1	−3

(i) Stable when

(ii) Unstable when

5(b)

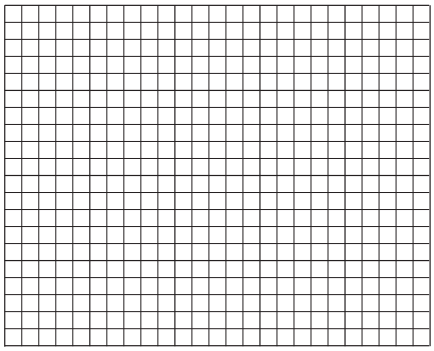
X	Y	Z

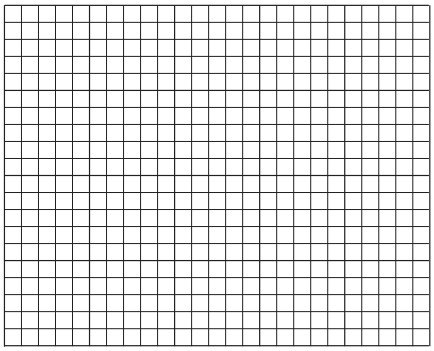
5(c)

(answer space continued on next page)

5(c) **(continued)**

For working, if required.





5(d)

6(a)

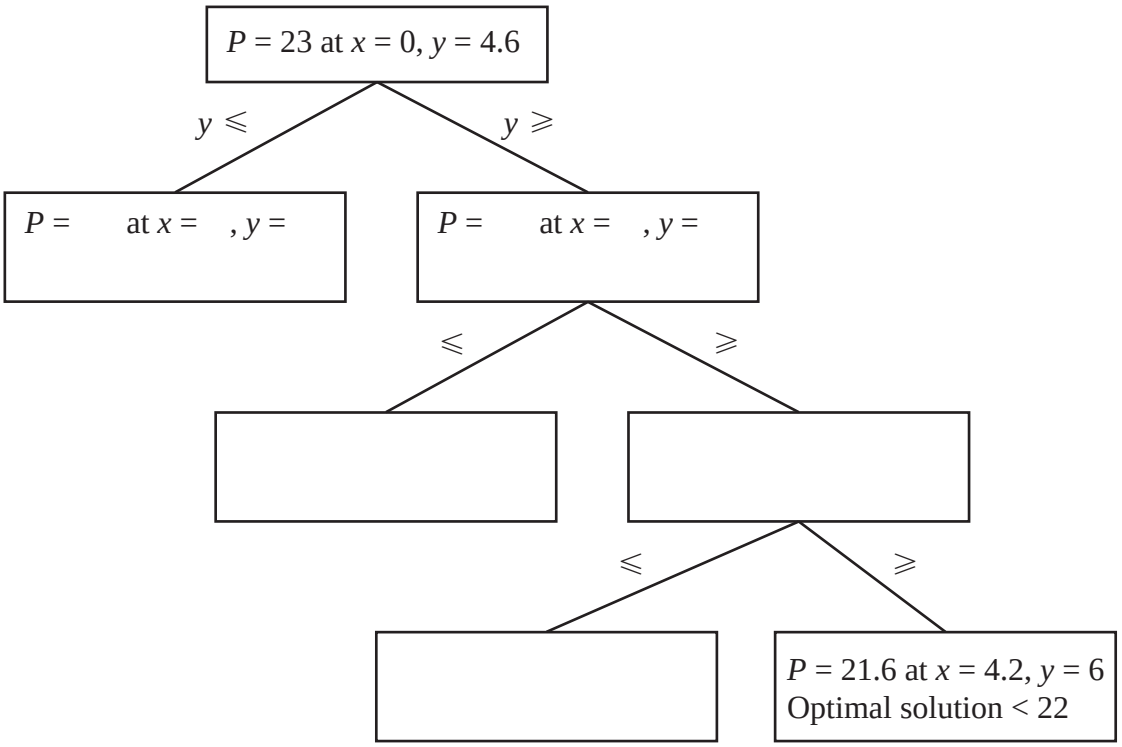
P	x	y	s	t	u	RHS
1	2	−5	0	0	0	0
0	2	1	1	0	0	25.8
0	−1	3	0	1	0	13.8
0	4	−3	0	0	1	18.8

Maximise $P =$

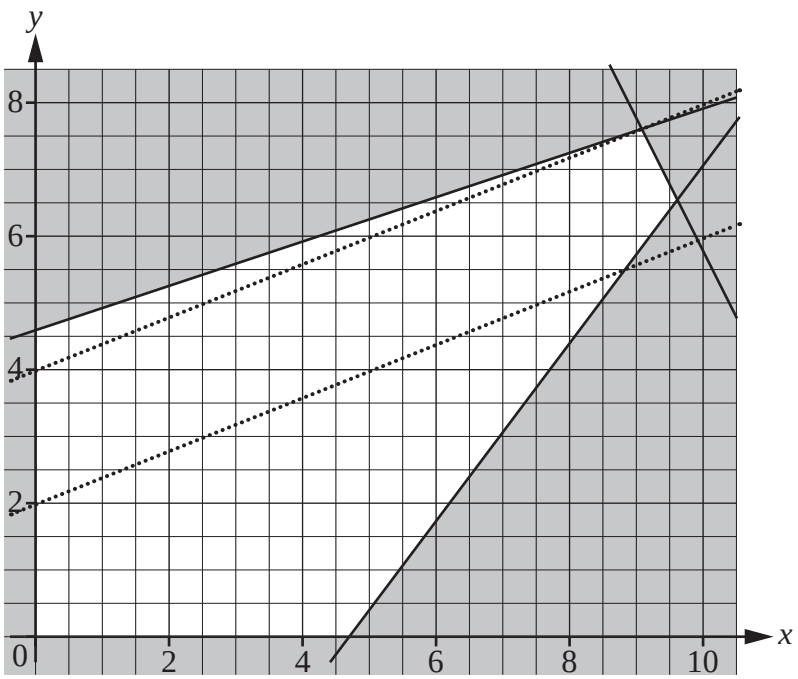
Subject to

and $x \geqslant 0, y \geqslant 0$

6(b)



For working, if required (there is another copy of this graph on the next page).

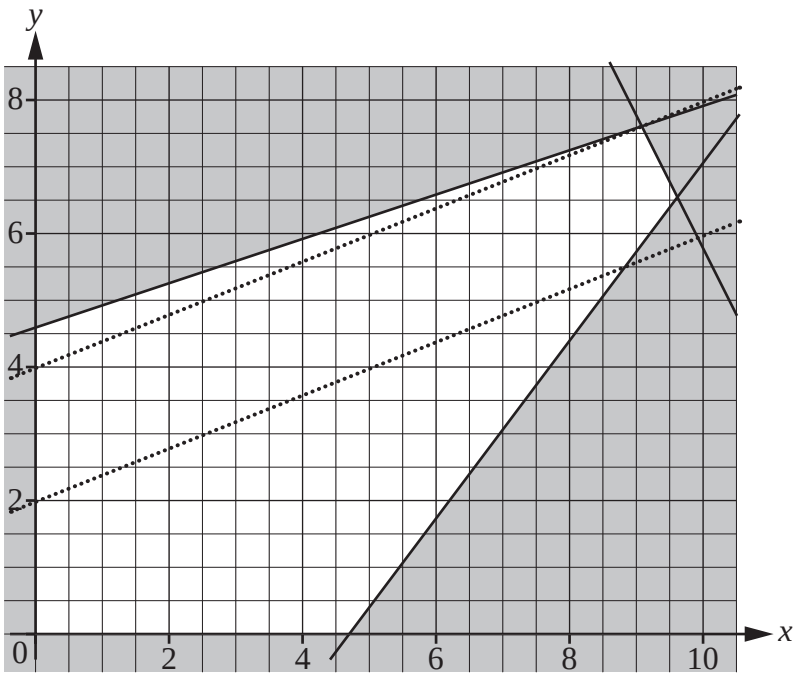


An optimal solution to the constrained problem is

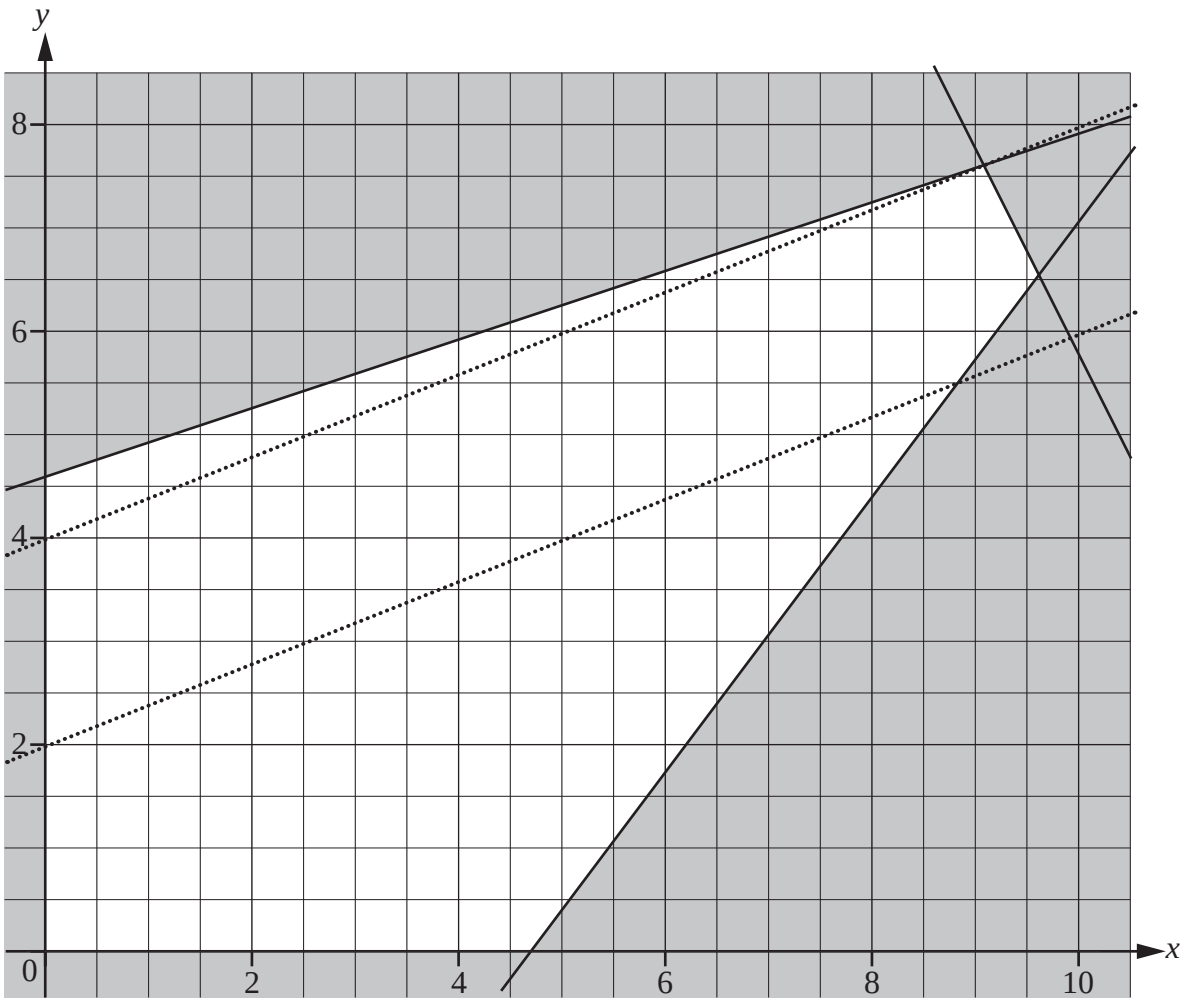
$P =$ when $x =$ and $y =$

(answer space continued on next page)

6(b) **(continued)** For working, if required.



6(c) For working, if required.



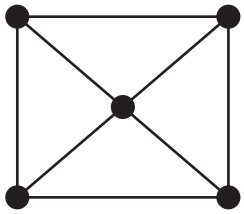
7(a)(i)	BUBBLE SORT								
	Original list:	2.9	0.9	1.5	3.5	4.2	5.3	4.7	2.3
	After 1st pass:								
	After 2nd pass:								
7(a)(ii)	SHUTTLE SORT								
	Original list:	2.9	0.9	1.5	3.5	4.2	5.3	4.7	2.3
	After 1st pass:								
	After 2nd pass:								
7(b)									

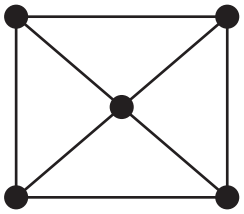
7(c)(i)

Sorted list: 0.9 1.5 2.3 2.9 3.5 4.2 4.7 5.3

7(c)(ii)

SPARE COPY





Total weight of minimum spanning tree:

7(c)(iii)

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).