A manufacturer makes two kinds of chairs, A and B, each of which has to be processed in two departments, 1 and 2.

Chair A has to be processed in department 1 for 3 hours and department 2 for 2 hours. It has a selling price of £10.

Chair B has to be processed in department 1 for 3 hours and department 2 for 4 hours, and has a selling price of £12.

In a given month the total time available in department 1 is 120 hours and department 2 is 150 hours.

How many of each chair should the manufacturer make that month to maximise his income?

A haulage company receives an order to transport 1600 packages.

They have large vans which can take 200 packages, and cost £40 a journey to run. They also have small vans which can take 80 packages, and cost £20 each to run for the same journey.

It is required that not more than £340 be spent on running the vans, and also that the number of small vans used must not exceed the number of large vans.

How many of each van should be used to keep costs as low as possible?

A book publisher is planning to produce a book in three different bindings: paperback, book club and library.

A paperback takes 2 minutes to sew, 4 minutes to glue, and sells for a profit of 25p.
A book club edition takes 2 minutes to sew, 6 minutes to glue, and sells for a profit of 40p.
A library edition takes 3 minutes to sew, 10 minutes to glue, and sells for a profit of 60p.

The sewing process is available for 7 hours per day and the gluing process for 11 hours per day.

How many books of each binding should the manufacturer make on a given day to maximise her profits?

Formulating linear programming problems: Exercise

Example	Variables	Objective	Constraints
A manufacturer makes two kinds of chairs, A and B, each of which has to be processed in two departments, 1 and 2. Chair A has to be processed in department 1 for 3 hours and department 2 for 2 hours. It has a selling price of £10. Chair B has to be processed in department 1 for 3 hours and department 2 for 4 hours, and has a selling price of £12. In a given month the total time available in department 1 is 120 hours and department 2 is 150 hours. How many of each chair should the manufacturer make that month to maximise his income?			
A haulage company receives an order to transport 1600 packages. They have large vans which can take 200 packages, and cost £40 a journey to run. They also have small vans which can take 80 packages, and cost £20 each to run for the same journey. It is required that not more than £340 be spent on running the vans, and also that the number of small vans used must not exceed the number of large vans. How many of each van should be used to keep costs as low as possible?			
A book publisher is planning to produce a book in three different bindings: paperback, book club and library. A paperback takes 2 minutes to sew, 4 minutes to glue, and sells for a profit of 25p. A book club edition takes 2 minutes to sew, 6 minutes to glue, and sells for a profit of 40p. A library edition takes 3 minutes to sew, 10 minutes to glue, and sells for a profit of 60p. The sewing process is available for 7 hours per day and the gluing process for 11 hours per day. How many books of each binding should the manufacturer make on a given day to maximise her profits?			

Formulating linear programming problems: Exercise Solutions

Example	Variables	Objective	Constraints
A manufacturer makes two kinds of chairs, A and B, each of which has to be processed in two departments, 1 and 2. Chair A has to be processed in department 1 for 3 hours and department 2 for 2 hours. It has a selling price of £10. Chair B has to be processed in department 1 for 3 hours and department 2 for 4 hours, and has a selling price of £12. In a given month the total time available in department 1 is 120 hours and department 2 is 150 hours. How many of each chair should the manufacturer make that month to maximise his income?	Number of Chair A = x Number of Chair B = y	Maximise $P = 10x + 12y$	$x, y > 0$ Integer constraint $3x + 3y \leq 120$ $2x + 4y \leq 150$
A haulage company receives an order to transport 1600 packages. They have large vans which can take 200 packages, and cost £40 a journey to run. They also have small vans which can take 80 packages, and cost £20 each to run for the same journey. It is required that not more than £340 be spent on running the vans, and also that the number of small vans used must not exceed the number of large vans. How many of each van should be used to keep costs as low as possible?	Number of small vans = x Number of large vans = y	Minimise $C = 20x + 40y$	$x, y > 0$ Integer constraint $80x + 200y \geq 1600$ $x \leq y$ $20x + 40y \leq 340$
A book publisher is planning to produce a book in three different bindings: paperback, book club and library. A paperback takes 2 minutes to sew, 4 minutes to glue, and sells for a profit of 25p. A book club edition takes 2 minutes to sew, 6 minutes to glue, and sells for a profit of 40p. A library edition takes 3 minutes to sew, 10 minutes to glue, and sells for a profit of 60p. The sewing process is available for 7 hours per day and the gluing process for 11 hours per day. How many books of each binding should the manufacturer make on a given day to maximise her profits?	Number of paperbacks = x Number of book club editions = y Number of library editions = z	Maximise $P = 25x + 40y + 60z$	$x, y, z > 0$ Integer constraint $2x + 2y + 3z \leq 420$ $4x + 6y + 10z \leq 660$

Example 1

A farmer has 75 hectares of land on which to grow a mixture of wheat and potatoes. Each hectare of wheat requires 30 hours of labour and 700kg of fertiliser; potatoes require 50 hours of labour and 400kg of fertiliser per hectare. There are 2800 hours of labour and 40 tonnes of fertiliser available. Wheat gives a profit of £80 per hectare and potatoes £100 per hectare. The farmer wishes to decide how much of each crop to grow to maximise his profit.

Decision Variables:

Objective Function:

Constraints:

Example 2:

A furniture company sells three types of dining chairs. All of the chairs pass through cutting, assembly and finishing workshops. Each workshop runs for 40 hours per week. The times in the workshop for each chair and the profit made from each are shown in the table. How many of each should be made per week to maximise weekly profit?

Chair Type	Cutting (hours)	Assembly (hours)	Finishing (hours)	Profit (£)
A	0.5	1	0.75	60
B	0.75	1.25	0.75	80
C	0.5	0.75	0.5	50

Decision Variables:

Objective Function:

Constraints:

Teacher notes:

To formulate linear programming problems

Decide your decision variables: x = the number of , y = the number of

Define your objective function: Maximise or minimise an equation

Define your constraints: including >0 and integer constraints