Question 1 **20 Marks**

(a) The digits 6, 2, 9, and 5 are written on four cards as shown:

6	2	9	5

The cards can be rearranged to make different four-digit numbers, for example:

9	6	5	2	$= 9652.$

Rearrange the cards to give:

(i) an odd number

5629 *or similar. (Any number using the 4 digits and ending in 9 or 5.)*

(ii) the smallest possible number.

2569

(b) Insert operators to make each calculation below correct.

Use the operators $+$, $-$, and $\times$.

Example: $3 \square 2 \square 5 = 13$

Answer: $3 + 2 \times 5 = 13$

(i) $3 - 2 + 5 = 6$

(ii) $3 \times 2 - 5 = 1$

Question 2 **20 Marks**

(a) **(i)** Michael buys five items in a shop.
He estimates the total cost of his purchases by rounding each item to the nearest euro, and then adding the estimates.

Complete the table to show Michael's calculations.

Item	Actual Cost	Estimate (nearest euro)
Magazine	€2·80	3
Milk	€1·79	2
Banana	34 cent	0
Bread	€1·23	1
Biscuits	79 cent	1
Total	€6·95	7

(ii) Find the difference between the actual total cost and Michael's estimate of the total cost.

€7 − 6·95 = €0·05, *or* 5 cent.

(b) The numbers in the table below were rounded using different methods.
Complete the table.

Number	Rounded number	Rounded to…
851·7	852	the nearest whole number
0·0026	0·003	three decimal places
798·798	798·8	one decimal place
12·342*, or similar (incl. 12·34)*	12·34	two decimal places

Question 3 **20 Marks**

(a) Last month, Ciara spent $\frac{1}{5}$ of her pocket money on snacks and spent $\frac{1}{2}$ of her pocket money on phone credit. She put the remainder of her pocket money into her credit union account.

(i) What fraction of her pocket money did she spend?

$^1/_5 + {}^1/_2 = {}^2/_{10} + {}^5/_{10} = {}^7/_{10}$

(ii) The amount she put into her credit union account was €12.
How much pocket money did Ciara receive for the month?

$^3/_{10} = €12$

$^1/_{10} = €4$

$^{10}/_{10} = €40$

(b) There are 45 sweets in a box.
The sweets are to be divided between three children in the ratio of their ages.
The children are aged 2, 3, and 4 years old.

How many sweets will each child get?

$2 + 3 + 4 = 9$ parts.

$45 \div 9 = 5$ sweets per part.

$2 \times 5 = 10$ sweets

$3 \times 5 = 15$ sweets

$4 \times 5 = 20$ sweets

Question 4 **20 Marks**

The table below shows the values when 3 is raised to certain powers.

(i) Complete the table.

Power of 3	Expanded power of 3	Answer
3^1	3	3
3^2	3×3	9
3^3	$3 \times 3 \times 3$	27
3^4	$3 \times 3 \times 3 \times 3$	81
3^5	$3 \times 3 \times 3 \times 3 \times 3$	243

(ii) 3^8 is 6561.

Explain how you could use this to find the value of 3^9 without using a calculator.

Multiply 6561 by 3 *or* $3^8 \times 3^1 = 3^9$ *or equivalent.*

Question 5 **15 Marks**

(a) John was asked to give an example of a set.
He said: "The set of good websites."

Explain why this is **not** a set.

You can't say for sure if some websites are good or not, *or equivalent.* *Explanation should include the idea that this is* ***not well-defined****.*

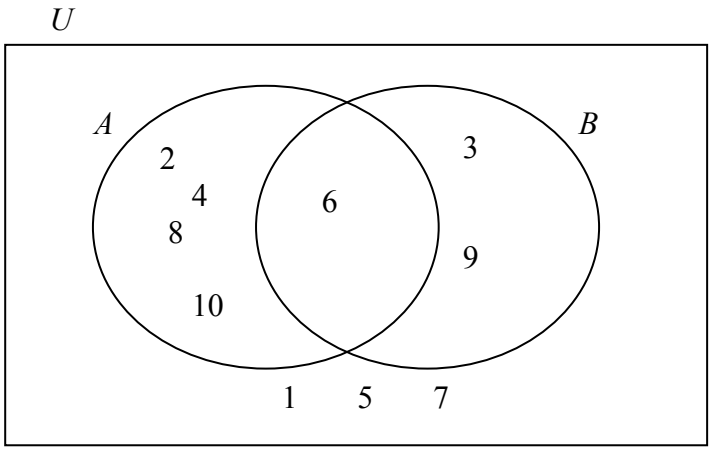
(b) The sets U, A, and B are defined as follows:

$U = \{1,\ 2,\ 3,\ 4,\ 5,\ 6,\ 7,\ 8,\ 9,\ 10\}$

A is the set of multiples of 2, from 1 to 10 inclusive

B is the set of multiples of 3, from 1 to 10 inclusive.

(i) Use these sets to fill in the Venn diagram.

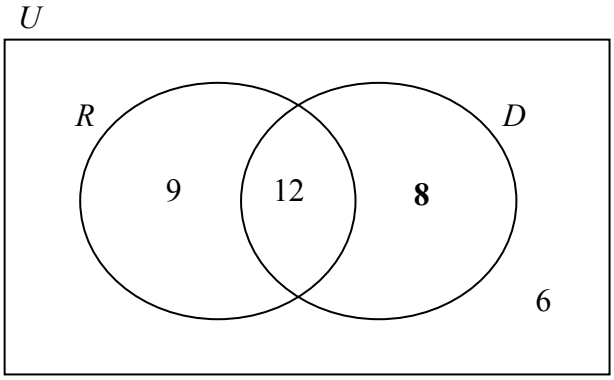


(ii) Using your Venn diagram, find the smallest number that is both a multiple of 2 **and** a multiple of 3 (the least common multiple).

6

Question 6 **25 Marks**

As part of a survey, 35 students were asked if they like Rihanna (R) or One Direction (D).
Some of the results are shown in the Venn diagram below.



(i) Complete the Venn diagram.

$9 + 12 + 6 = 27$

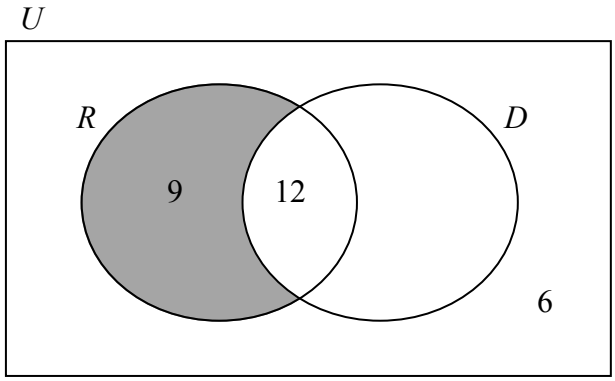
$35 - 27 = 8$

See diagram.

(ii) How many pupils liked One Direction?

$12 + 8 = 20$

(iii) Shade the region of the Venn diagram which represents $R \setminus D$.



(iv) Describe in your own words what this shaded region represents.

The students who liked Rihanna but not One Direction, *or equivalent*.

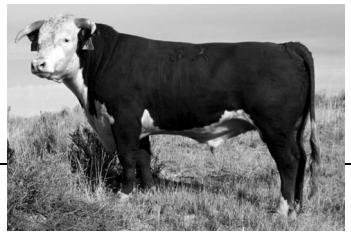
Question 7 **10 Marks**

VAT in Ireland is charged at different rates on different items. For instance:

Children's shoes have a VAT rate of 0%
Bulls have a VAT rate of 4·8%
Newspapers have a VAT rate of 9%.

(a) A pair of children's shoes costs €20 **before** VAT is added.
Write down the cost of the shoes **after** VAT is added.

€20

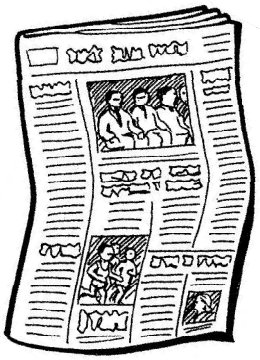


(b) A bull is sold for €1600 **before** VAT is added.
Find the cost of the bull **after** VAT is added.

4·8% of €1600 = €76·80

€1600 + €76·80 = €1676·80

(c) A newspaper costs €2·18 **after** VAT is added.
Find the cost of the newspaper **before** VAT is added.



109% = €2·18

1% = €0·02

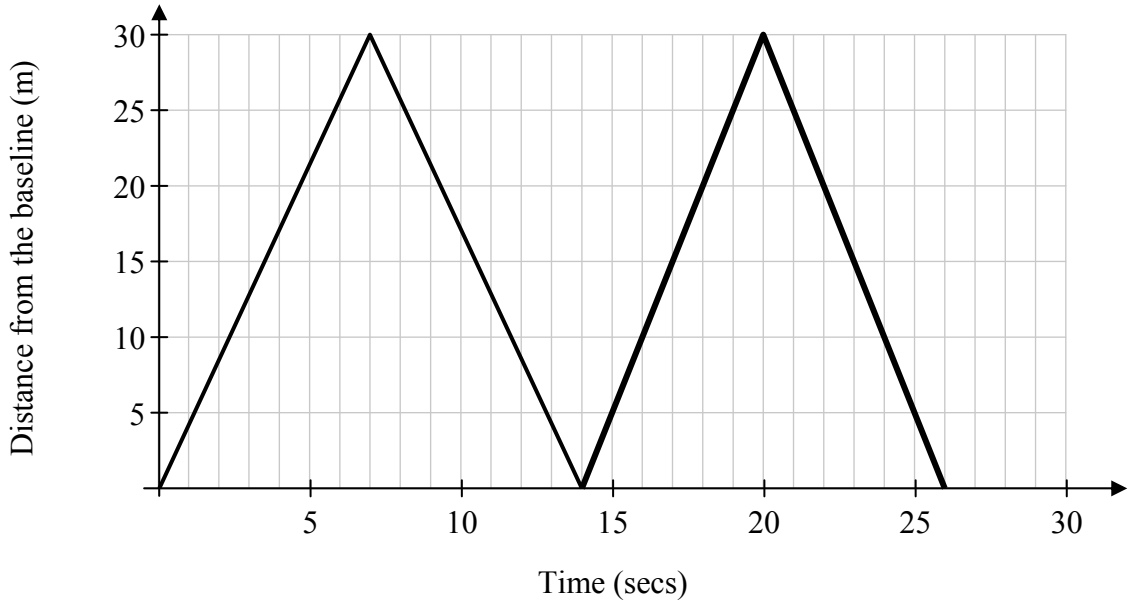
100% = €2

Question 8 **20 Marks**

The students in a PE class are doing a fitness test.

Each student runs from the *baseline* of the gym to the *halfway line* of the gym, and back again. This is called a *lap*. They run a number of laps in the fitness test.

The graph below shows Miriam's distance from the baseline for her first lap.



(i) From the graph, how long did it take Miriam to complete her first lap?

14 seconds

(ii) From the graph, how far is the *baseline* of the gym from the *halfway line* of the gym?

30 m

(iii) For her second lap, Miriam increases her average speed to 5 metres per second.
On the diagram, continue the graph to show her distance from the baseline over the course of this lap.

See diagram. (No working out required – for each second you go out on the vertical axis, you go up/down 5 metres.)	*Or*: $\text{Time} = \frac{\text{Distance}}{\text{Speed}}$ $= \frac{30}{5}$ $= 6$ seconds for half lap, total time 12 seconds *See diagram.*

Question 9 **15 Marks**

(i) Fill in the first difference and the second difference for the following patterns. Some of Pattern 1 has been completed for you.

Pattern 1: 2 4 9 17 28

First difference: (*Change*) 2 **5** 8 11

Second difference: (*Change of change*) 3 3 **3**

Pattern 2: –1 2 5 8 11

First difference: (*Change*) 3 3 3 3

Second difference: (*Change of change*) 0 0 0

(ii) State whether each pattern is **linear** or **quadratic**. Give a reason for each answer.

Pattern 1:	Quadratic
Reason:	First difference changes, second difference is constant, *or equivalent*
Pattern 2:	Linear
Reason:	First difference is constant, *or equivalent*

Question 10 **30 Marks**

(a) Factorise fully each of the following expressions.

(i) $5x + 10$

$5(x + 2)$

(ii) $rc - sc + 2rd - 2sd$

$(c + 2d)(r - s)$

(iii) $x^2 - 16$

$(x + 4)(x - 4)$

(b) **(i)** Factorise $x^2 - 5x + 6$.

$(x - 3)(x - 2)$

(ii) Using your answer from **(b)(i)**, or otherwise, solve the equation $x^2 - 5x + 6 = 0$.

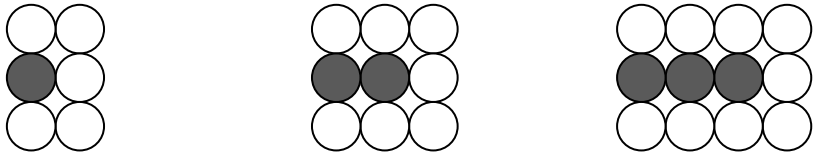
$(x - 3)(x - 2) = 0$ $x = 3 \quad x = 2$

(iii) Verify **one** of your answers from **(b)(ii)**.

Either: $3^2 - 5(3) + 6 = 0$ $9 - 15 + 6 = 0$ $0 = 0$	*Or*: $2^2 - 5(2) + 6 = 0$ $4 - 10 + 6 = 0$ $0 = 0$

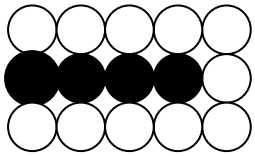
Question 11 **15 Marks**

The first three stages of a pattern are shown below.
Each stage is made up of a certain number of shaded discs and a certain number of white discs.



1st Stage 2nd Stage 3rd Stage

(i) Shade in the appropriate discs below to show the 4th stage of the pattern.



(ii) Complete the table below to show how the pattern continues.

Number of Shaded Discs	Number of White Discs
1	5
2	7
3	9
4	11
5	13
6	15

(iii) In a particular stage of the pattern, there are 21 white discs.
How many shaded discs are there in this stage of the pattern?

9

(iv) Write down the relation between the number of shaded discs and the number of white discs in each stage of the pattern. State clearly the meaning of any letters you use.

There are 2 extra white discs for each extra shaded disc. There is 1 shaded disc and 5 white discs at the start.	*Or*: Shaded discs = n White discs = $3 + 2n$

Question 12 **15 Marks**

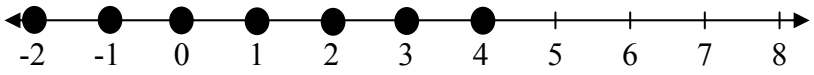
(a) $\mathbb{Z}$ is the set of integers. Explain what an integer is.

Integers are all the whole numbers; *or*: An integer is an element of {....−3, −2, −1, 0, 1, 2, 3 ...}; *or equivalent.*

(b) **(i)** Solve the inequality $-7+2x\leq 1$, where $x\in\mathbb{Z}$.

$2x\leq 1+7$ $2x\leq 8$ $x\leq 4$

(ii) Graph your solution to **(b)(i)** on the number line given below.



Question 13 **15 Marks**

Eva bought an Xbox for US$199·95, when she was on holidays in the United States.
The exchange rate was US$1·33 = €1.

(i) Convert the cost of the Xbox to euro. Write your answer correct to the nearest cent.

€199·95 ÷ 1·33 = €150·34 (to the nearest cent)

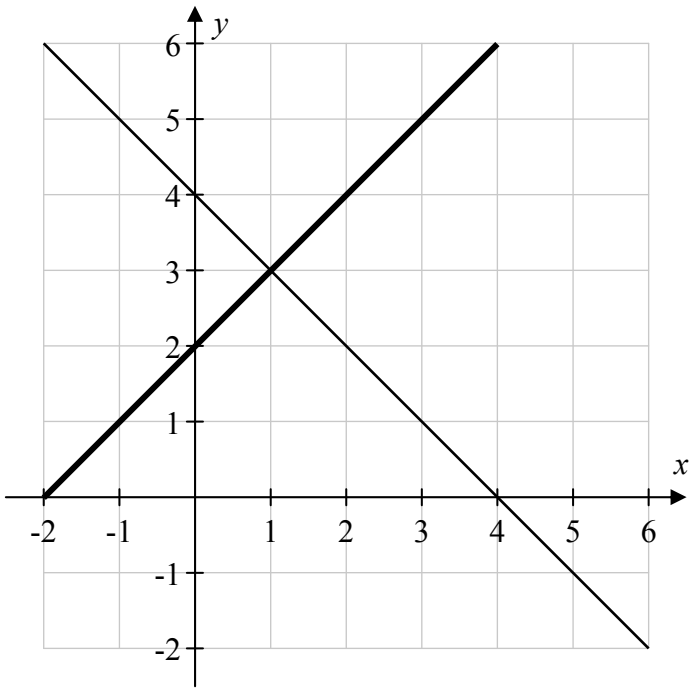
An Xbox of the same model costs €269·99 in Ireland.

(ii) How much money did Eva save by buying the Xbox in the United States?

€269·99 − €150·34 = €119·65

Question 14 **10 Marks**

The graph of the line $y = -x + 4$ is shown below.



(i) Using the same axes and scales, draw the graph of the line $y = x + 2$.

Line cuts axes at (0,2) and (-2,0), or line cuts y-axis at 2 and has slope of 1. See diagram.

(ii) From the graphs, state the point of intersection of the two lines.

(1, 3)

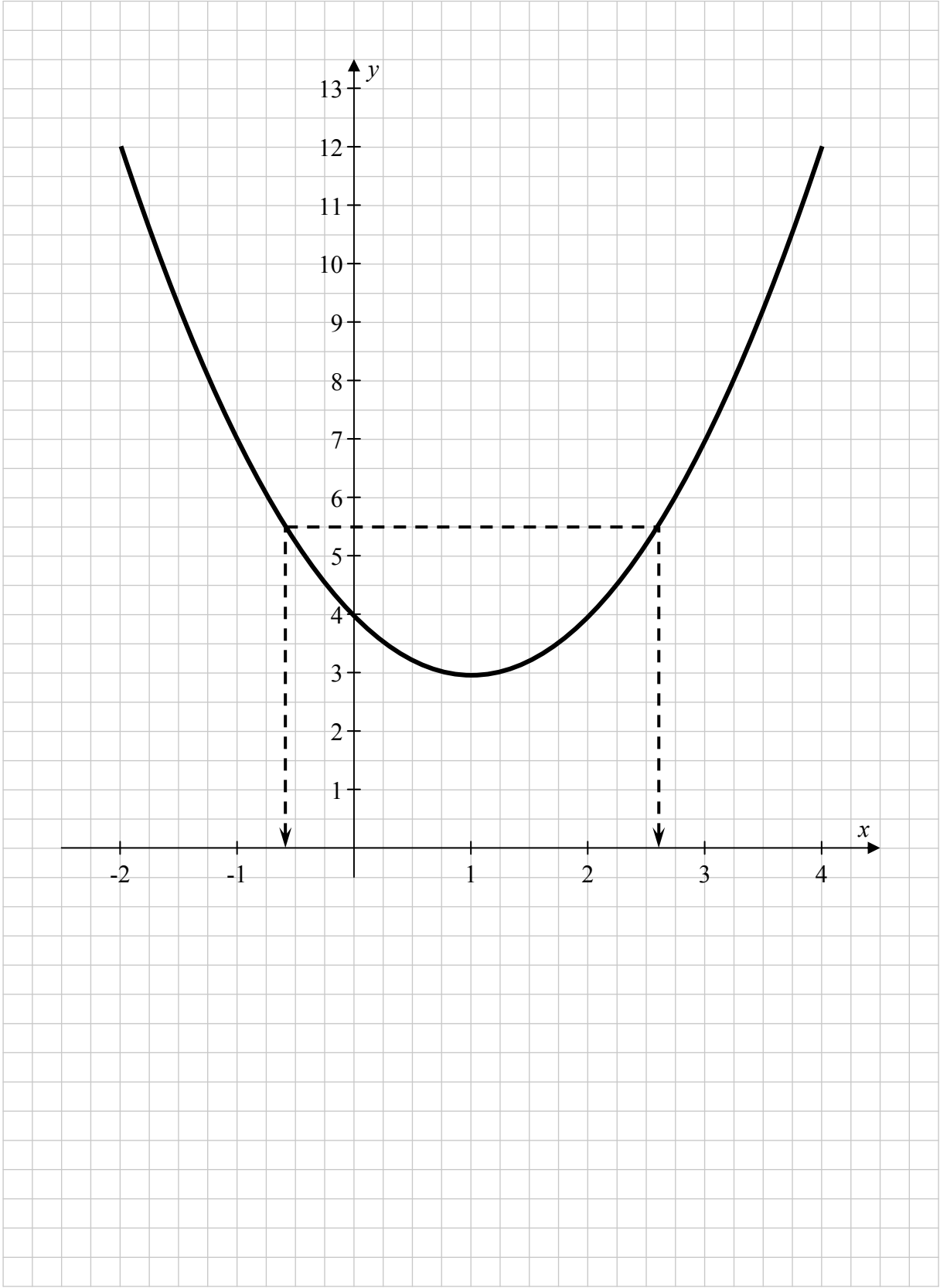
(iii) Verify your answer to **(ii)** using algebra.

Either simultaneous equations, e.g.:	*Or sub (1,3) into the equation of each line*:
$y = -x + 4$	$y = -x + 4$
$\underline{y = x + 2}$	$3 = -1 + 4$
$2y = 6$	$3 = 3$
$y = 3$	
	and:
$\Rightarrow x = 1$	$y = x + 2$
	$3 = 1 + 2$
$\Rightarrow$ Point of intersection is (1, 3)	$3 = 3$

Question 15 **50 Marks**

(i) Draw the graph of the function $f : x \mapsto x^2 - 2x + 4$ in the domain $-2 \le x \le 4$, where $x \in \mathbb{R}$.

There is more room for working out on the next page.



$f(-2) = 12$

$f(-1) = 7$

$f(0) = 4$

$f(1) = 3$

$f(2) = 4$

$f(3) = 7$

$f(4) = 12$

The function $f : x \mapsto x^2 - 2x + 4$ gives the predicted wind speed, in km per hour, over a 6-hour period of time.

The x-axis represents the time from 10 p.m. ($x = -2$) to 4 a.m. ($x = 4$).

Use your graph from **(i)** to answer the following questions. Show your work on the graph.

(ii) What is the predicted wind speed at midnight?

4 km/h

(iii) Find the times when the predicted wind speed is 5·5 km per hour.

See diagram. 11:25 p.m. and 2:35 a.m.

(iv) If the wind speed is between 1·1 km per hour and 5·5 km per hour, it is called *light air*.

According to your graph, for how long will the wind be *light air*?

3 hours and 10 minutes.