10 John and Paul are carrying out an experiment.

The table shows their results for x and y.

x	0	2	3	4
y	4	0	0.25	0

Paul proposes that the relationship should be modelled by $y = k(x - 2)(x - 4)$. This is shown in Fig. 10.
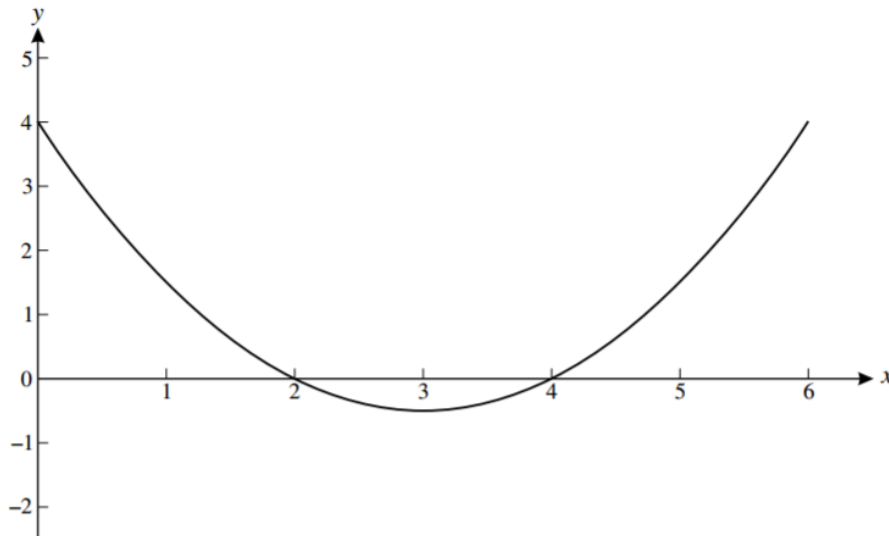
Fig. 10

(i) Find the value of k for which the points (0, 4), (2, 0) and (4, 0) satisfy this equation. **[2]**

John proposes a different model, using $y = c(x - 2)^2(x - 4)$.

(ii) Find the value of c for which the points (0, 4), (2, 0) and (4, 0) satisfy this equation. **[2]**

(iii) Which is the better model for John and Paul's results? Give a reason for your answer. **[2]**

13 Ali and Beth make components in a factory. Ali works faster than Beth and makes 3 more components per hour. As a result he takes 2 hours less time than Beth to make 72 components.

Let t hours be the time that Ali takes to make 72 components.

(i) Write expressions for the numbers of components made per hour by Ali and by Beth. **[3]**

(ii) Hence derive the equation $3t(t + 2) = 144$. **[5]**

(iii) Solve this equation to find the times that Ali and Beth take to make 72 components. **[4]**

3   This year John is 4 times as old as his son Paul. In 5 years' time John will be only 3 times as old as Paul.

Let the age of Paul now be x years.

By forming an equation in x and solving it, find Paul's age now.   **[4]**

12   Paul walked from Anytown to Nexttown, a distance of 15 km. When he got there he then walked back. His average speed on the return journey was 2 km per hour less than on the outward journey.

Let Paul's average speed on the outward journey be x km hr^{-1}.

   (i) Write down an expression for the time, in hours, taken for the whole journey.   **[2]**

The time taken by Paul for the whole journey was 6 hours.

   (ii) Use your expression in **(i)** to form an equation in x and show that it simplifies to

$$x^2 - 7x + 5 = 0.$$ **[4]**

   (iii) Solve this equation to find Paul's average speed on the outward journey.   **[3]**

   (iv) Find the difference in time between the outward and return journeys. Give your answer to the nearest minute.   **[3]**

6   You are given that n is a positive integer and $(n-1), n, (n+1)$ are three consecutive integers.

In each of the following cases form an equation in n and solve it.

   (i)   The three integers add up to 99.   **[2]**

   (ii)   When the product of the first integer and third integer is added to 5 times the second integer the sum is 203.   **[4]**

10   Simon and Gavin drive a distance of 140 km along a motorway, both at constant speed. Simon drives at 5 km per hour faster than Gavin.

Let Gavin's speed be v km per hour.

   (i) Write down expressions in terms of v for the times, in hours, taken by Gavin and Simon.   **[2]**

Simon completes the journey in 15 minutes less than Gavin.

   (ii) Explain why $\dfrac{140}{v} - \dfrac{140}{v+5} = \dfrac{1}{4}$ and show that this equation reduces to the equation

$$v^2 + 5v - 2800 = 0.$$ **[5]**

   (iii) Solve this equation to find v and hence find the times taken by Simon and Gavin. Give your answers correct to the nearest minute.   **[5]**

9 **(i)** Find the values of the constants a and b such that, for all values of x

$$x^2 + 8x + 19 = (x + a)^2 + b.$$

[3]

(ii) Hence state the least value of $x^2 + 8x + 19$ and the value of x at which this occurs. [2]

(iii) Write down the greatest value of $\dfrac{1}{x^2 + 8x + 19}$. [1]