

## PROBLEM SOLVING

### Question 1

A rocket fired from Earth travels in a parabolic path. The equation for the path is :  
 $h = -0.04x^2 + 6x$  where  $h$  is the height of the rocket in km above the earth's surface and  $x$  is the horizontal distance travelled in km.

a. Find the height of the rocket after it has travelled a horizontal distance of:

i. 20 km

$$h = -0.04 \times 20^2 + 6 \times 20 = 104 \text{ km}$$

ii. 80 km

$$h = -0.04 \times 80^2 + 6 \times 80 = 224 \text{ km}$$

b. Factorize:  $-0.04x^2 + 6x$

$$\cancel{20 \times 6} \times -0.04x(x - 150)$$

c. i. Find the values of  $x$  for which  $h = 0$ .

$$h = -0.04x(x - 150)$$

$h = 0 \quad \text{at} \quad x = 0, 150.$

ii. Hence, state the horizontal distance from its launching site at which the rocket returns to the ground.

150 km from launch site

d. i. What is the value of  $x$  at which the rocket reaches its maximum height?

$$x = 75$$

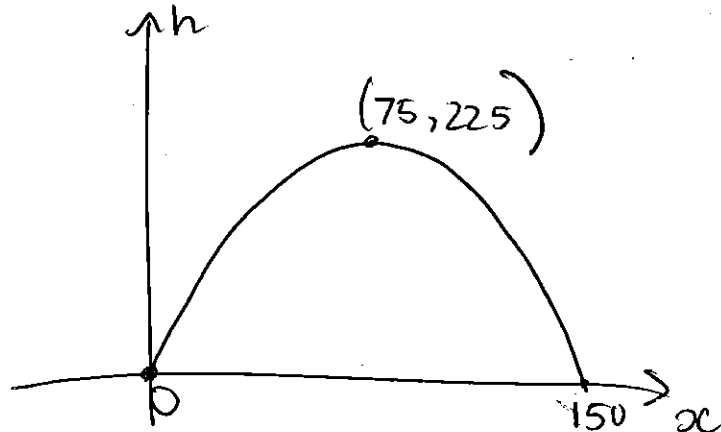
ii. By doing an appropriate calculation, determine the maximum height reached by the rocket.

$$h(x) = -0.04x(x - 150)$$

$$h(75) = 225$$

Maximum height = 225 km

e. Sketch the graph of the path of the rocket. Indicate clearly the x-intercepts and the coordinate of the turning point.



f. Determine the values of  $x$  for which the rocket is 161 m above the ground.

$$161 = -0.04x(x-150)$$

$$\text{Solving : } x = 35, 115$$

g. What is the practical domain of the function  $h(x)$ ?

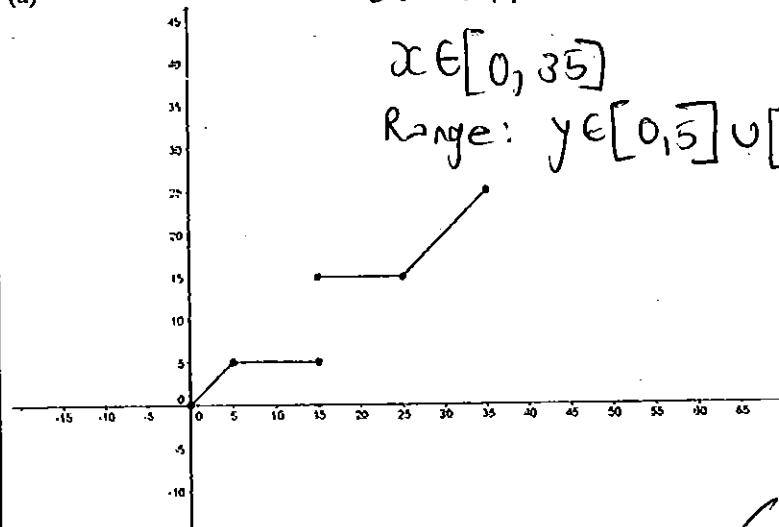
$$0 \leq x \leq 150$$

$$\text{or; } x \in [0, 150]$$

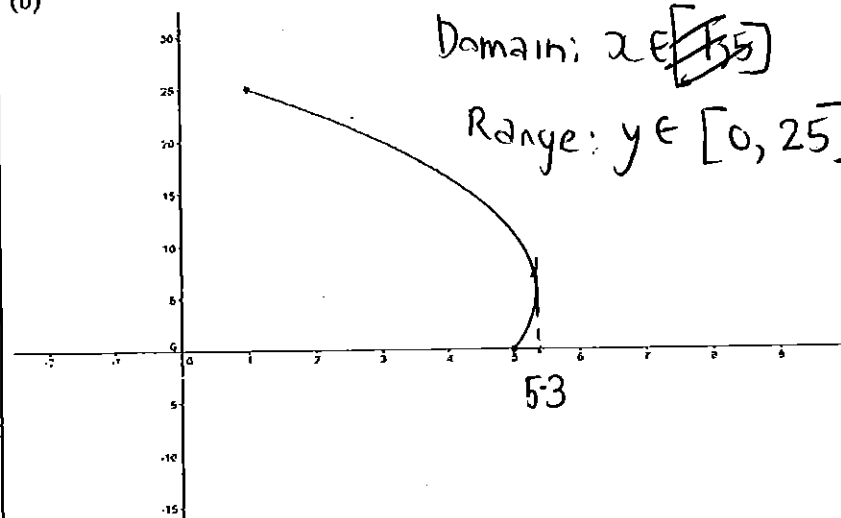
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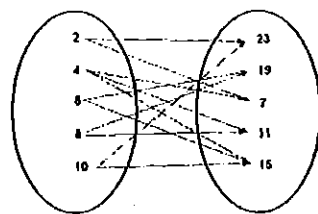
For the graphs shown, state the domain and range.

(a)



(b)



4	<p>Describe the mapping shown below.</p>  <p style="text-align: center;">many to many relation</p>																
5	<p>Complete a table of values for the function <math>f(x) = 3x + 4</math>.</p> <table border="1"> <tr> <td><math>x</math></td> <td>-3</td> <td>-1</td> <td>0</td> <td>1</td> <td>3</td> <td>6</td> <td>10</td> </tr> <tr> <td><math>f(x)</math></td> <td>-5</td> <td>1</td> <td>4</td> <td>7</td> <td>13</td> <td>22</td> <td>34</td> </tr> </table> <p style="text-align: center;"> <math>3x + 4 = 22</math>                      <math>3x + 4 = 34</math>  <math>x = 6</math>                                      <math>x = 10</math> </p>	$x$	-3	-1	0	1	3	6	10	$f(x)$	-5	1	4	7	13	22	34
$x$	-3	-1	0	1	3	6	10										
$f(x)$	-5	1	4	7	13	22	34										
6	<p>State the domain and range of the following relation. Is the relation a function?</p> <p style="text-align: right;">Domain: <math>\{2, 3, 4, 6\}</math></p> <p><math>\{(2, -3), (4, 6), (3, -1), (6, 6), (2, 3)\}</math>                      <u>Not a function</u></p>																
7	<p>State the domain and range of the following relation. Is the relation a function?</p> <p><math>\{(-3, 5), (-2, 5), (-1, 5), (0, 5), (1, 5), (2, 5)\}</math></p> <p>Domain: <math>\{-3, -2, -1, 0, 1, 2\}</math></p>																

Range:  $\{5\}$   
 Yes; it is a function.

Range:  $\{-3, 1, 3, 6\}$

9 If  $f(x) = 3x + 10$ , what is

(a)  $f(2)$   $f(2) = 3 \times 2 + 10 = 16$

(b)  $f(0)$   $f(0) = 10$

(c)  $f(-3)$   $f(-3) = 3 \times -3 + 10 = 1$

(d)  $f(a)$   $f(a) = 3a + 10$

10 What is the range of this function?

$f(x) = 2x - 5, x < 2$

Range:  
 $y \in (-\infty, -1)$   
 or  $\{y: y < -1\}$

11 Complete a table of values for the function:  
 $f(x) = 3x^2 - 2x + 7$ .

x	-3	-1	0	1	3	5	10
f(x)	<del>36</del>	<del>12</del>	7	8	28	72	287

$f(-3) = 3 \times (-3)^2 - 2 \times -3 + 7 = 27 + 6 + 7 = 40$   
 $f(-1) = 3 \times (-1)^2 - 2 \times (-1) + 7 = 3 + 2 + 7 = 12$   
 $f(1) = 3 \times 1^2 - 2 \times 1 + 7 = 8$   
 $f(3) = 3 \times 3^2 - 2 \times 3 + 7 = 28$   
 $f(5) = 3 \times 5^2 - 2 \times 5 + 7 = 72$   
 $f(10) = 3 \times 10^2 - 2 \times 10 + 7 = 287$

$f(10) = 3 \times 10^2 - 2 \times 10 + 7 = 287$