HIGHER

2.5 Direct and Inverse Proportion With Non-Linear Powers: Test Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 65 minutes

Name: _____ Date: ____ / ____ / _____

Answer all questions. Full sentences are required in 2 questions (where an explanation is asked). Allow 65 minutes.

1 The time, t seconds, an object takes to fall from rest is directly proportional to the square root of the height, h metres, it falls. It takes 6 seconds to fall 16 m.
Find the time it takes to fall 25 m.

(Total for Question 1 is 4 marks)

2 The power P is directly proportional to the cube of the voltage V and inversely proportional to the resistance R.
When V = 3 and R = 6, P = 324.
Find the value of P when V = 3 and R = 4.

(Total for Question 2 is 5 marks)

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3 E is inversely proportional to v. When v = 10, E = 18.
Find the value of E when v = 6.

(Total for Question 3 is 4 marks)

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4 Similar toy blocks are made from the same material, so their mass M grams is directly proportional to the cube of their length L cm. A block of length 5 cm has mass 250 grams.
Find the mass of a block of length 4 cm.

(Total for Question 4 is 4 marks)

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5 The power P is directly proportional to the cube of the voltage V and inversely proportional to the resistance R.
When V = 2 and R = 3, P = 120.
Find the value of P when V = 4 and R = 3.

(Total for Question 5 is 5 marks)

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6 A is directly proportional to the square root of r. When r = 100, A = 50.
Find the value of A when r = 4.

(Total for Question 6 is 4 marks)

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7 The time, t seconds, an object takes to fall from rest is directly proportional to the square root of the height, h metres, it falls. It takes 5 seconds to fall 9 m.
Find the time it takes to fall 36 m.

(Total for Question 7 is 4 marks)

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8 The power P is directly proportional to the cube of the voltage V and inversely proportional to the resistance R.
When V = 3 and R = 4, P = 216.
Find the value of P when V = 5 and R = 4.

(Total for Question 8 is 5 marks)

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9 W is directly proportional to the square root of h. When h = 16, W = 4.
Find the value of W when h = 64.

(Total for Question 9 is 4 marks)

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10 E is directly proportional to the square root of v. When v = 4, E = 12.
Find the positive value of v when E = 42.

(Total for Question 10 is 4 marks)

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Mark scheme · 2.5 Direct and Inverse Proportion With Non-Linear Powers: Test Pack

Question 1

$t = k\sqrt{h}$	**M1**
$k = 6/\sqrt{16} = 3/2$	**M1**
$t = 3/2 \times \sqrt{25}$	**M1**
$t = 15/2$ seconds	**A1**

Answer: t = 15/2 seconds

Question 2

$P = kV^3/R$	**M1**
substitutes to get $324 = k \times 27/6$	**M1**
$k = 72$	**A1**
$P = 72 \times 27/4$	**M1**
$P = 486$	**A1**

Answer: P = 486

Question 3

writes the relationship as $E = k/v$	**M1**
substitutes $v = 10$, $E = 18$ to find k	**M1**
$k = 180$, so $E = 180/v$	**A1**
$E = 30$ when $v = 6$	**A1**

Answer: E = 30

Question 4

$M = kL^3$	**M1**
$250 = k \times 5^3$	**M1**
$k = 2$	**A1**
$M = 2 \times 4^3 = 128$ grams	**A1**

Answer: M = 128 grams

Question 5

$P = kV^3/R$	**M1**
substitutes to get $120 = k \times 8/3$	**M1**
$k = 45$	**A1**
$P = 45 \times 64/3$	**M1**
$P = 960$	**A1**

Answer: P = 960

Question 6

writes the relationship as $A = k\sqrt{r}$	**M1**
substitutes $r = 100$, $A = 50$ to find k	**M1**
$k = 5$, so $A = 5\sqrt{r}$	**A1**
$A = 10$ when $r = 4$	**A1**

Answer: A = 10

Question 7

$t = k\sqrt{h}$	**M1**
$k = 5/\sqrt{9} = 5/3$	**M1**
$t = 5/3 \times \sqrt{36}$	**M1**
$t = 10$ seconds	**A1**

Answer: t = 10 seconds

Question 8

$P = kV^3/R$	**M1**
substitutes to get $216 = k \times 27/4$	**M1**
$k = 32$	**A1**
$P = 32 \times 125/4$	**M1**
$P = 1000$	**A1**

Answer: P = 1000

Question 9

writes the relationship as $W = k\sqrt{h}$	**M1**
substitutes $h = 16$, $W = 4$ to find k	**M1**
$k = 1$, so $W = \sqrt{h}$	**A1**
$W = 8$ when $h = 64$	**A1**

Answer: W = 8

Question 10

writes $E = k\sqrt{v}$ and substitutes to find k	**M1**
$k = 6$	**A1**
substitutes $E = 42$ into $E = 6\sqrt{v}$ and rearranges for v	**M1**
$v = 49$ cao	**A1**

Answer: v = 49

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