# Direct/Inverse Variation and Cubic Models: exam practice

10 questions · 29 marks · worked solutions and markschemes

Name _____ Date _____ Score / 29

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlai/direct-inverse-variation-and-cubic-models-exam-practice

**1.** **3 marks · Paper 1 style · calculator allowed**

$y$ varies directly as the square of $x$. When $x = 4$, $y = 40$.

Find $y$ when $x = 7$. **[3]**

**2.** **2 marks · Paper 1 style · calculator allowed**

The time $T$ to complete a job is inversely proportional to the number of workers $n$. $6$ workers take $15$ days.

Find the time taken by $9$ workers. **[2]**

**3.** **2 marks · Paper 2 style · calculator allowed**

The period $T$ of a pendulum varies as the square root of its length $L$. A $0.8$ m pendulum has period $1.79$ s.

Find the period of a $2$ m pendulum. **[2]**

**4.** **2 marks · Paper 1 style · calculator allowed**

The force $F$ between two magnets varies inversely as the cube of the distance between them. When the distance is halved, find the factor by which $F$ changes.

Find the factor. **[2]**

**5.** **2 marks · Paper 1 style · calculator allowed**

The cost $C$ of a circular rug varies directly as the square of its diameter. A rug of diameter $1.5$ m costs $\$90$.

Find the cost of a rug of diameter $2.4$ m. **[2]**

**6.** **3 marks · Paper 2 style · calculator allowed**

The volume of water in a tank, in litres, is modelled by $V(t) = -0.2t^3 + 3t^2 + 50$ for $0 \leq t \leq 15$ hours.

Find the maximum volume and when it occurs. **[3]**

**7.** **3 marks · Paper 1 style · calculator allowed**

$y$ is inversely proportional to $\sqrt{x}$, and $y = 6$ when $x = 9$.

Find $y$ when $x = 4$, and $x$ when $y = 3$. **[3]**

**8.** **4 marks · Paper 2 style · calculator allowed**

The intensity $I$ of light varies inversely as the square of the distance $d$ from the source. At $2$ m, $I = 45$ units.

Find $I$ at $5$ m and the distance at which $I = 5$. **[4]**

**9.** **4 marks · Paper 2 style · calculator allowed**

A box is made from a $30$ cm by $20$ cm sheet by cutting squares of side $x$ cm from each corner.

Write the volume as a cubic in $x$ and find the maximum volume. **[4]**

**10.** **4 marks · Paper 2 style · calculator allowed**

A cubic model $y = a(x-1)(x-4)(x-6)$ passes through $(0, -48)$.

Find $a$ and the coordinates of the local maximum. **[4]**

## Answers and worked solutions

### Question 1

3 marks

**Answer:** $\frac{245}{2}$

$y = kx^2$, $40 = 16k$ M1

$k = 2.5$ A1

$y = 122.5$ A1

### Question 2

2 marks

**Answer:** $10$

$T = \dfrac{90}{n}$ M1

$10$ days A1

### Question 3

2 marks

**Answer:** $2.83\ s$

$T = 1.79\sqrt{\dfrac{2}{0.8}}$ M1

$2.83\ s$ A1

### Question 4

2 marks

**Answer:** $8$

$F \propto d^{-3}$, $\left(\dfrac{1}{2}\right)^{-3}$ M1

$8$ A1

### Question 5

2 marks

**Answer:** $\$230.40$

$C = 40d^2$ M1

$\$230.40$ A1

### Question 6

3 marks

**Answer:** $150$ litres at $t = 10$

$V'(t) = -0.6t^2 + 6t = 0$ M1

$t = 10$ A1

$V = 150$ litres A1

### Question 7

3 marks

**Answer:** $y = 9$; $x = 36$

$y = \dfrac{18}{\sqrt{x}}$ A1

$y = 9$ A1

$x = 36$ A1

### Question 8

4 marks

**Answer:** $7.2$ units; $6\ m$

$I = \dfrac{k}{d^2}$, $k = 180$ $M1$A1

$7.2$ units A1

$d = 6\ m$ A1

### Question 9

4 marks

**Answer:** $x = 3.92$ cm, $V = 1060\ \text{cm}^3$

$V = x(30 - 2x)(20 - 2x)$ A1

GDC maximum M1

$x = 3.92$ A1

$V = 1060\ \text{cm}^3$ A1

### Question 10

4 marks

**Answer:** $a = 2$; $(2.21,\ 16.4)$

$-48 = a(-1)(-4)(-6)$ M1

$a = 2$ A1

GDC **(M1)**

$(2.21,\ 16.4)$ A1

Every solution is also on ibmathrevision.com/hlai/direct-inverse-variation-and-cubic-models-exam-practice
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