7.3 Direct and Inverse Proportion Depth: 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 E is inversely proportional to the square of v. When v = 3, E = 16. Find a formula for E in terms of v.

(Total for Question 1 is 2 marks)

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2 E is inversely proportional to the square of v. When v = 6, E = 50. Find the value of E when v = 5.

(Total for Question 2 is 3 marks)

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3 E is directly proportional to the square of v. When v = 7, E = 392. Find a formula for E in terms of v.

(Total for Question 3 is 2 marks)

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4 y is directly proportional to the cube of x. When x = 2, y = 32. Find the value of y when x = 3.

(Total for Question 4 is 3 marks)

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5 P is directly proportional to the square of t. When t = 2, P = 36. Find the value of P when t = 3.

(Total for Question 5 is 3 marks)

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6 y is inversely proportional to x. When x = 4, y = 15. Find the value of y when x = 10.

(Total for Question 6 is 3 marks)

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7 The table shows some values of x and y, where y is directly proportional to x.

x	2	5	8
y	6	?	24

(a) Find the missing value of y in the table. **(1)**

.....

(b) Find the value of x for which y = 30. **(2)**

.....

(Total for Question 7 is 3 marks)

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8 y is directly proportional to x^2. y = 32 when x = 4.

(a) Find a formula for y in terms of x. **(2)**

.....

(b) Work out the value of y when x = 10. **(1)**

.....

(c) Work out the positive value of x when y = 50. **(2)**

.....

(Total for Question 8 is 5 marks)

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9 y is directly proportional to x^3. When x = 2, y = 40.

(a) Find a formula for y in terms of x. **(2)**

.....

(b) Work out the value of y when x = 4. **(2)**

.....

(Total for Question 9 is 4 marks)

---

10 y is directly proportional to $\sqrt{x}$. When x = 16, y = 12.

(a) Find a formula for y in terms of x. **(2)**

.....

(b) Work out the value of y when x = 25. **(2)**

.....

(Total for Question 10 is 4 marks)

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11 y is inversely proportional to x. When x = 4, y = 15.

(a) Find a formula for y in terms of x. **(1)**

.....

(b) Work out the value of y when x = 12. **(1)**

.....

(Total for Question 11 is 2 marks)

---

12 y is inversely proportional to x^2. When x = 2, y = 18.

(a) Find a formula for y in terms of x. **(2)**

.....

(b) Work out the positive value of x when y = 8. **(3)**

.....

(Total for Question 12 is 5 marks)

---

13 The energy, E joules, stored in a spring is directly proportional to the square of its extension, x cm. When x = 3, E = 45.

(a) Find a formula for E in terms of x. **(2)**

.....

(b) Find the value of E when x = 6. **(1)**

.....

(c) Find the value of x when E = 80. **(1)**

.....

(Total for Question 13 is 4 marks)

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14 y is directly proportional to $\sqrt{x}$. When x = 16, y = 20.

(a) Find a formula for y in terms of x. **(2)**

.....

(b) Find the value of y when x = 25. **(1)**

.....

(c) Find the value of x when y = 30. **(1)**

.....

(Total for Question 14 is 4 marks)

---

15 y is inversely proportional to x^2. When x = 2, y = 12.

(a) Find a formula for y in terms of x. **(2)**

.....

(b) Find the value of y when x = 4. **(1)**

.....

(c) Find the value of x when y = 0.75. **(1)**

.....

(Total for Question 15 is 4 marks)

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16 F is inversely proportional to d^3. When d = 5, F = 8.

(a) Find a formula for F in terms of d. **(2)**

.....

(b) Find the value of F when d = 10. **(1)**

.....

(c) Find the value of d when F = 125. **(1)**

.....

(Total for Question 16 is 4 marks)

---

17 The time, T hours, taken to build a wall is inversely proportional to the number of workers, w. It takes 6 workers 8 hours to build the wall.

(a) Find a formula for T in terms of w. **(2)**

.....

(b) How long would it take 4 workers to build the same wall? **(2)**

.....

(Total for Question 17 is 4 marks)

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18 P is directly proportional to Q and inversely proportional to R. When Q = 8 and R = 4, P = 6.

(a) Find a formula for P in terms of Q and R. **(3)**

.....

(b) Work out the value of P when Q = 12 and R = 2. **(2)**

.....

(c) Work out the value of R when P = 9 and Q = 15. **(2)**

.....

(Total for Question 18 is 7 marks)

---

19 The resistance, R ohms, of a wire is directly proportional to its length, L metres, and inversely proportional to the square of its diameter, d millimetres. A wire of length 2 m and diameter 0.5 mm has a resistance of 8 ohms.

(a) Find a formula for R in terms of L and d. **(3)**

.....

(b) Find the resistance of a wire of the same material with length 5 m and diameter 1 mm. **(2)**

.....

(Total for Question 19 is 5 marks)

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20 y is directly proportional to x^n, where n is a positive integer. When x = 2, y = 12. When x = 8, y = 768. Find the value of n. Hence find the value of y when x = 32.

(Total for Question 20 is 5 marks)

---

21 p is inversely proportional to q^2. The value of q is decreased by 50%. Work out the percentage change in the value of p, stating whether it is an increase or a decrease.

(Total for Question 21 is 3 marks)

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22 The braking distance, d metres, of a car is directly proportional to the square of its speed, s mph. A car travelling at 30 mph has a braking distance of 18 m.

(a) Find a formula for d in terms of s. **(2)**

.....

(b) Work out the braking distance of a car travelling at 50 mph. **(2)**

.....

(c) A different car needs a braking distance of 72 m to come to a stop. Assuming the same relationship, find the speed of this car. **(3)**

.....

(Total for Question 22 is 7 marks)

---

23 A is directly proportional to B^2 and inversely proportional to C. When B = 3 and C = 4, A = 18.

(a) Find a formula for A in terms of B and C. **(3)**

.....

(b) Work out the value of A when B = 6 and C = 8. **(2)**

.....

(Total for Question 23 is 5 marks)

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Mark scheme · 7.3 Direct and Inverse Proportion Depth: 2-hour Pack

Question 1

uses a constant of proportionality in a correct relationship **M1**

$E = 144/v^2$ oe **A1**

Answer: $E = 144/v^2$

Question 2

sets up equation with a constant of proportionality **M1**

$k = 1800$ **A1**

$E = 72$ cao **A1**

Answer: E = 72

Question 3

uses a constant of proportionality in a correct relationship **M1**

$E = 8v^2$ oe **A1**

Answer: $E = 8v^2$

Question 4

sets up equation with a constant of proportionality **M1**

$k = 4$ **A1**

$y = 108$ cao **A1**

Answer: y = 108

Question 5

sets up equation with a constant of proportionality **M1**

$k = 9$ **A1**

$P = 81$ cao **A1**

Answer: P = 81

Question 6

finds the constant of proportionality $k = xy = 4 \times 15 (=60)$ **M1**

correct method $y = k/x$, substituting $x = 10$ (ft) **M1**

$y = 6$ cao **A1**

Answer: y = 6

Question 7

(a) $y = 15$ cao **B1**

(a) Answer: 15

(b) uses $k = 3$ (ft) to set up $30 = 3x$, or equivalent scale factor method **M1**

(b) $x = 10$ cao **A1**

(b) Answer: 10

Question 8

(a) finds $k = 32/4^2 (= 32/16)$ oe **M1**

(a) $y = 2x^2$ oe **A1**

(a) Answer: $y = 2x^2$

(b) $y = 200$ (ft their formula) **B1**

(b) Answer: y = 200

(c) sets up $50 = 2x^2$ leading to $x^2 = 25$ oe **M1**

(c) $x = 5$ cao **A1**

(c) Answer: x = 5

Question 9

(a) finds $k = 40/2^3 (= 40/8)$ oe **M1**

(a) $y = 5x^3$ oe **A1**

(a) Answer: $y = 5x^3$

(b) substitutes $x = 4$ into their formula **M1**

(b) $y = 320$ cao **A1**

(b) Answer: y = 320

Question 10

(a) finds $k = 12/\sqrt{16} (= 12/4)$ oe **M1**

(a) $y = 3\sqrt{x}$ oe **A1**

(a) Answer: $y = 3\sqrt{x}$

(b) substitutes $x = 25$: $y = 3\sqrt{25}$ **M1**

(b) $y = 15$ cao **A1**

(b) Answer: y = 15

Question 11

(a) $y = 60/x$ oe ($k = 60$) **B1**

(a) Answer: y = 60/x

(b) $y = 5$ cao (ft their formula) **B1**

(b) Answer: y = 5

Question 12

(a) finds $k = 18*2^2 (= 18*4)$ oe **M1**

(a) $y = 72/x^2$ oe **A1**

(a) Answer: $y = 72/x^2$

(b) sets up $8 = 72/x^2$ oe (ft their formula) **M1**

(b) rearranges to $x^2 = 9$ oe **M1**

(b) $x = 3$ cao (positive root only) **A1**

(b) Answer: x = 3

Question 13

(a) $k = 45/3^2 (=5)$ **M1**

(a) $E = 5x^2$ oe **A1**

(a) Answer: $E = 5x^2$

(b) $E = 180$ (ft) **B1**

(b) Answer: 180

(c) $x = 4$ cao **B1**

(c) Answer: 4

Question 14

(a) $k = 20/\sqrt{16} (=20/4=5)$ **M1**

(a) $y = 5\sqrt{x}$ oe **A1**

(a) Answer: $y = 5\sqrt{x}$

(b) $y = 25$ cao **B1**

(b) Answer: 25

(c) $x = 36$ cao **B1**

(c) Answer: 36

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Question 15

(a) $k = 12 \times 2^2$ (=48) **M1**

(a) $y = 48/x^2$ oe **A1**

(a) Answer: $y = 48/x^2$

(b) y = 3 cao **B1**

(b) Answer: 3

(c) x = 8 cao **B1**

(c) Answer: 8

Question 16

(a) $k = 8 \times 5^3$ (=1000) **M1**

(a) $F = 1000/d^3$ oe **A1**

(a) Answer: $F = 1000/d^3$

(b) F = 1 cao **B1**

(b) Answer: 1

(c) d = 2 cao **B1**

(c) Answer: 2

Question 17

(a) k = wT = 6 x 8 (=48) **M1**

(a) T = 48/w oe **A1**

(a) Answer: T = 48/w

(b) T = 48/4 (ft from part a) **M1**

(b) 12 hours cao **A1**

(b) Answer: 12 hours

Question 18

(a) writes P = kQ/R oe **M1**

(a) substitutes Q = 8, R = 4, P = 6 to form an equation for k, e.g. 6 = k x 8/4 **M1**

(a) k = 3, so P = 3Q/R oe cao **A1**

(a) Answer: P = 3Q/R

(b) substitutes into P = 3Q/R (ft): P = 3 x 12/2 **M1**

(b) P = 18 cao **A1**

(b) Answer: 18

(c) rearranges and substitutes (ft): R = 3 x 15/9 **M1**

(c) R = 5 cao **A1**

(c) Answer: 5

Question 19

(a) writes $R = kL/d^2$ oe **M1**

(a) substitutes L = 2, d = 0.5, R = 8 to form an equation for k, e.g. 8 = k x 2/0.25 **M1**

(a) k = 1, so $R = L/d^2$ oe cao **A1**

(a) Answer: $R = L/d^2$

(b) substitutes L = 5, d = 1 into $R = L/d^2$ (ft) **M1**

(b) R = 5 ohms cao **A1**

(b) Answer: 5 ohms

Question 20

forms the ratio 768/12 (=64) and expresses in terms of powers of 2, e.g. $2^{3n}/2^n = 2^{2n}$ oe (accept use of logarithms) **M1**

solves $2^{2n} = 64 = 2^6$, giving 2n = 6 **M1**

n = 3 **A1**

finds k using $k = 12/2^3$ (=1.5) oe **M1**

y = 49152 cao **A1**

Answer: n = 3; y = 49152 when x = 32

Question 21

identifies the new q as 0.5q oe (or q/2) **M1**

finds new $p = k/(0.5q)^2 = 4k/q^2$ oe (= 4p) **M1**

300% increase cao (accept p becomes 4 times as large) **A1**

Answer: 300% increase

Question 22

(a) finds $k = 18/30^2$ (= 18/900, = 1/50) oe **M1**

(a) $d = s^2/50$ oe (accept $d = 0.02s^2$) **A1**

(a) Answer: $d = s^2/50$

(b) substitutes s = 50 into their formula **M1**

(b) 50 m cao **A1**

(b) Answer: 50 m

(c) sets up $72 = s^2/50$ oe (ft their formula) **M1**

(c) rearranges to $s^2 = 3600$ oe, dependent on the first M1 **M1**

(c) 60 mph cao **A1**

(c) Answer: 60 mph

Question 23

(a) states $A = kB^2/C$ oe **M1**

(a) substitutes to form $18 = k*3^2/4$ (= 9k/4), dependent on the first M1 **M1**

(a) k = 8, so $A = 8B^2/C$ oe **A1**

(a) Answer: $A = 8B^2/C$

(b) substitutes B = 6, C = 8 into their formula (ft their formula) **M1**

(b) A = 36 cao **A1**

(b) Answer: A = 36

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