7.3 Direct and Inverse Proportion Depth: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 y is directly proportional to x. Write down the equation connecting y and x using a constant k.

(Total for Question 1 is 1 mark)

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2 Three graphs, A, B and C, each show y plotted against x for $x > 0$. Graph A is a straight line through the origin. Graph B is a curve that starts high up on the y-axis, decreases steeply, and gets closer and closer to the x-axis without ever touching it, and never touches the y-axis either. Graph C is a straight line that crosses the y-axis above the origin (it does not pass through the origin).

(a) State which graph, A, B or C, could show y directly proportional to x. **(1)**

(b) State which graph, A, B or C, could show y inversely proportional to x. **(1)**

(c) Explain why graph C cannot show y directly proportional to x, or y inversely proportional to x. **(1)**

(Total for Question 2 is 3 marks)

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3 y is inversely proportional to x. When $x = 4$, $y = 35$. Find a formula for y in terms of x.

(Total for Question 3 is 2 marks)

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4 The cost, C pounds, of a length of ribbon is directly proportional to its length, L metres. 3 metres of ribbon costs £4.50.

(a) Work out the cost of 8 metres of the same ribbon. **(2)**

.....

(b) Sarah has £10.50 to spend on this ribbon. Work out the maximum length of ribbon she can buy. **(2)**

.....

(Total for Question 4 is 4 marks)

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5 y is directly proportional to x^2. Find the effect on the value of y when the value of x is doubled.

(Total for Question 5 is 2 marks)

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6 The time, T hours, taken for a car journey is inversely proportional to its average speed, S mph. When S = 40, T = 3.

(a) Find a formula for T in terms of S. **(1)**

.....

(b) Work out the time taken for the same journey at an average speed of 60 mph. **(2)**

.....

(c) The journey is instead driven so that it takes 2.4 hours. Work out the average speed required. **(2)**

.....

(Total for Question 6 is 5 marks)

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7 The tables show corresponding values of x and y.

(a)

x	2	4	6
y	8	32	72

(2)

Determine, giving a reason, whether y could be directly proportional to x^2.

(b)

x	1	2	3
y	5	11	19

(2)

Determine, giving a reason, whether y could be directly proportional to x^2.

(Total for Question 7 is 4 marks)

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8 Using 3 identical pumps, it takes 100 minutes to fill a swimming pool. The time taken, T minutes, is inversely proportional to the number of pumps used, n. Work out the minimum number of pumps needed to fill the pool in no more than 40 minutes.

(Total for Question 8 is 3 marks)

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9 P is inversely proportional to Q. When Q = 3, P = 8. Show that when Q = 6, P = 4.

(Total for Question 9 is 2 marks)

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10 A company claims that the cooking time, T minutes, needed for a joint of meat of mass m kg is directly proportional to m. The company's own cooking instructions state that a 2 kg joint needs 50 minutes, and that a 5 kg joint needs 110 minutes.

(a) Using the data for the 2 kg joint, and assuming T is directly proportional to m, find the value of k in T = km. **(1)**

.....

(b) Use your value of k to predict the cooking time needed for a 5 kg joint. **(1)**

(c) Hence, giving a reason, state whether the company's claim that T is directly proportional to m is correct. **(2)**

(Total for Question 10 is 4 marks)

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11 The signal strength, S bars, received from a phone mast is inversely proportional to the square of the distance, d km, from the mast. When d = 2, S = 63.

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

.....

(b) Work out the signal strength at a distance of 6 km. **(2)**

.....

(c) Priya says: 'If you treble the distance from the mast, the signal strength becomes a third of what it was.' Using your answers to parts (a) and (b), or otherwise, explain whether Priya is correct. **(2)**

.....

.....

.....

.....

.....

(Total for Question 11 is 6 marks)

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12 p is inversely proportional to q^3. When q = 2, p = 1.

(a) Find a formula for p in terms of q. **(2)**

.....

(b) Work out the value of p when q = 4. **(2)**

.....

(Total for Question 12 is 4 marks)

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13 y is inversely proportional to x^2. Prove algebraically that when x is multiplied by 3, y is divided by 9.

(Total for Question 13 is 3 marks)

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Mark scheme · 7.3 Direct and Inverse Proportion Depth: Test Pack

Question 1

y = kx oe **B1**

Answer: y = kx

Question 2

(a) A **B1**

(a) Answer: Graph A

(b) B **B1**

(b) Answer: Graph B

(c) states that graph C does not pass through the origin, so it cannot be y = kx (oe); or states that it is a straight line, not a reciprocal curve, so it cannot be y = k/x (oe) - either correct reason is sufficient **B1**

(c) Answer: Graph C is a straight line not through the origin, so it cannot be direct proportion (y = kx must pass through the origin); and it is not a curve of the form y = k/x, so it cannot be inverse proportion either.

Question 3

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

y = 140/x oe **A1**

Answer: y = 140/x

Question 4

(a) finds cost per metre: 4.50/3 (=1.50), or a correct scale factor method **M1**

(a) £12.00 cao **A1**

(a) Answer: £12 (£12.00)

(b) L = 10.50/1.50 (ft cost per metre from part a) **M1**

(b) 7 metres cao **A1**

(b) Answer: 7 metres

Question 5

finds new y = $k(2x)^2$ = $4kx^2$ oe **M1**

y is multiplied by 4 (increases by a factor of 4) cao **A1**

Answer: y is multiplied by 4

Question 6

(a) T = 120/S oe (k = 120) **B1**

(a) Answer: T = 120/S

(b) substitutes S = 60 into their formula **M1**

(b) 2 hours cao **A1**

(b) Answer: 2 hours

(c) sets up 2.4 = 120/S oe **M1**

(c) 50 mph cao **A1**

(c) Answer: 50 mph

Question 7

(a) finds y/x^2 for at least two pairs: 8/4 = 2, 32/16 = 2, 72/36 = 2 **M1**

(a) yes, y is directly proportional to x^2 since y/x^2 is constant (=2) oe **A1**

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

(b) finds y/x^2 for at least two pairs: 5/1 = 5, 11/4 = 2.75 **M1**

(b) no, y is not directly proportional to x^2 since y/x^2 is not constant oe **A1**

(b) Answer: No

Question 8

finds the constant of proportionality k = nT = 3 x 100 (=300) **M1**

n = 300/40 (=7.5) **M1**

8 pumps, with reasoning that the number of pumps must be a whole number and 7 pumps would take longer than 40 minutes **A1**

Answer: 8 pumps

Question 9

finds the constant of proportionality k = PQ = 3 x 8 (=24) **M1**

P = 24/6 = 4 cso **A1**

Answer: P = 4 (shown)

Question 10

(a) k = 25 **B1**

(a) Answer: k = 25

(b) 125 minutes (ft their k) **B1**

(b) Answer: 125 minutes

(c) compares their predicted time (125 minutes) with the actual instructed time (110 minutes) and notes they are different (dep on a correct or ft predicted time) **B1**

(c) concludes the claim is not correct, since direct proportion would require the predicted and actual times to match (oe) **B1**

(c) Answer: No, the claim is not correct, because the predicted time for the 5 kg joint (125 minutes) does not match the actual instructed time (110 minutes), so T is not directly proportional to m.

Question 11

(a) finds k = $63*2^2$ (= 63*4) oe **M1**

(a) S = $252/d^2$ oe **A1**

(a) Answer: $S = 252/d^2$

(b) substitutes d = 6 into their formula **M1**

(b) 7 (bars) cao **A1**

(b) Answer: 7 bars

(c) compares S at d = 2 (63) with S at d = 6 (7) and notes that 7 is a ninth of 63, not a third (dep on a correct or ft value from part b) **B1**

(c) concludes Priya is incorrect, because S is inversely proportional to d^2 (not d), so trebling d divides S by 9, not 3 (oe) **B1**

(c) Answer: Priya is incorrect. Trebling d from 2 to 6 changes S from 63 to 7, which is a ninth of the original value, not a third, because S is inversely proportional to d^2, not d.

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Question 12

(a) finds $k = 1*2^3$ (= 1*8) oe **M1**

(a) $p = 8/q^3$ oe **A1**

(a) Answer: $p = 8/q^3$

(b) substitutes q = 4 into their formula **M1**

(b) p = 1/8 cao (oe 0.125) **A1**

(b) Answer: p = 1/8

Question 13

states $y = k/x^2$ (or equivalent starting relationship) **M1**

substitutes 3x for x: $y_{new} = k/(3x)^2 = k/(9x^2)$, dependent on the first M1 **M1**

$y_{new} = (1/9)*(k/x^2) = y/9$, so y is divided by 9 (must reach an explicit conclusion linking back to the original y) cao **A1**

Answer: $y_{new} = y/9$, so y is divided by 9, as required.

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