5.2 Direct and Inverse Proportion: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A recipe uses 3 cups of flour to make 12 biscuits. Work out how many cups of flour are needed to make 4 biscuits.

(Total for Question 1 is 1 mark)

---

2 A supermarket sells apple juice in two sizes:
Small bottle: 750 ml for £1.35
Large bottle: 2 litres for £3.20
Determine which bottle is the better value for money. You must show your working.

(Total for Question 2 is 3 marks)

© Revision Library | revisionlibrary.co.uk

3 Inverse proportion in a simple setting. 5 painters can paint a fence in 9 hours. How long would 3 painters take to paint the same fence, working at the same rate?

(a) Find the time in hours for 3 painters. **(3)**

.....

(b) If each painter works 8 hours per day, how many whole days are needed to finish the job with 3 painters? Give your answer as a whole number of days. **(2)**

.....

(Total for Question 3 is 5 marks)

---

4 A car being driven at a constant average speed takes 3 hours to complete a journey when its average speed is 60 mph. The time taken, T hours, for the journey is inversely proportional to the average speed, S mph.

(a) Find a formula for T in terms of S. **(3)**

.....

(b) Work out the time taken for the same journey if the average speed is 40 mph. Give your answer in hours and minutes. **(3)**

.....

(Total for Question 4 is 6 marks)

© Revision Library | revisionlibrary.co.uk

5 Three tables of values are shown.

Table A

x: 1 2 5

y: 4 8 20

Table B

x: 1 2 5

y: 20 10 4

Table C

x: 1 2 5

y: 3 5 11

(a) State which table shows y directly proportional to x. Give a reason for your answer. **(2)**

(b) State which table shows y inversely proportional to x. Give a reason for your answer. **(2)**

(c) Explain why Table C shows neither direct nor inverse proportion between x and y. **(1)**

(Total for Question 5 is 5 marks)

---

6 y is inversely proportional to x. When x = 4, y = 9.

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

(b) Work out the value of x when y = 6. **(2)**

(Total for Question 6 is 4 marks)

© Revision Library | revisionlibrary.co.uk

7 y is directly proportional to x^3. x is increased by 20%. Work out the percentage increase in y.

(Total for Question 7 is 3 marks)

---

8 y is directly proportional to x^2. x is first doubled, and then the new value of x is trebled. Show that the overall effect is that y is multiplied by 36.

(Total for Question 8 is 3 marks)

---

9 A factory produces items at a rate directly proportional to the number of machines m and inversely proportional to the time h taken per shift. The production per shift P is modelled by P = c m / h. When the factory runs 12 machines and each shift lasts 8 hours, production is 480 items.

(a) Find c. **(2)**

(b) The factory increases machines by 50% and reduces shift length by 20%. Calculate the new production per shift. **(3)**

(c) Find the required number of machines to get P = 900 items per shift when h = 8 hours. Give an integer result and explain any rounding. **(3)**

(Total for Question 9 is 8 marks)

© Revision Library | revisionlibrary.co.uk

10 Two quantities x and y are related by $x = k / y^2$. When y = 2, x = 9.

(a) Find k. **(1)**

(b) Write y in terms of x and k, giving y in simplest form. **(3)**

(c) Hence or otherwise, find y when x = 1, giving an exact value. **(1)**

(Total for Question 10 is 5 marks)

---

11 A cyclist rides so that the time t (hours) to travel a fixed route is inversely proportional to her speed v (mph), since the route length is fixed. Last week she rode at speed v and completed the route in t hours. This week her speed decreases by 4 mph and she takes 15 minutes longer.

(a) Express the new speed in terms of v. **(1)**

(b) Write an equation linking t, v and the 15 minute increase and show that 16t = v - 4. **(3)**

(c) Hence find v in terms of t, simplifying fully, and find the value of v when t = 1.5 hours. **(4)**
Note: 15 minutes = 1/4 hour.

(Total for Question 11 is 8 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 5.2 Direct and Inverse Proportion: Test Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

1 cup cao	**B1**

Answer: 1 cup of flour (cao). (3 cups for 12 biscuits means 0.25 cups per biscuit; for 4 biscuits 0.25 x 4 = 1.)

Question 2

price per 100 ml (or per ml/litre) for the small bottle found, e.g. 1.35/750 x 100 = 0.18 (18p) oe	**M1**
price per 100 ml for the large bottle found, e.g. 3.20/2000 x 100 = 0.16 (16p) oe (2 litres = 2000 ml seen)	**M1**
large bottle, with correct comparison of their two values (dep on both M marks) oe	**A1**

Answer: Large bottle (16p per 100 ml versus 18p per 100 ml)

Question 3

(a) calculate total painter-hours: 5 x 9 = 45	**M1**
(a) divide total painter-hours by 3 to find time: 45/3	**M1**
(a) 15 hours cao	**A1**

(a) Answer: 15 hours

(b) convert hours to days: 15/8 = 1.875	**M1**
(b) 2 days cao	**A1**

(b) Answer: 2 days

Question 4

(a) T = k/S oe seen	**M1**
(a) 3 = k/60 solved (dependent on previous M1)	**dM1**
(a) T = 180/S oe	**A1**

(a) Answer: T = 180/S

(b) 180/40 (ft their formula)	**M1**
(b) 4.5 hours oe	**A1**
(b) 4 hours 30 minutes ft	**B1**

(b) Answer: 4 hours 30 minutes

Question 5

(a) Table A	**B1**
(a) valid reason, e.g. y/x is constant (= 4) for every pair oe	**B1**

(a) Answer: Table A

(b) Table B	**B1**
(b) valid reason, e.g. xy is constant (= 20) for every pair oe	**B1**

(b) Answer: Table B

(c) correct explanation, e.g. y/x is not constant (3, 2.5, 2.2) and xy is not constant (3, 10, 55) oe	**B1**

(c) Answer: Neither ratio y/x nor product xy is constant

Question 6

(a) finds k = 4 x 9 = 36 oe	**M1**
(a) y = 36/x oe	**A1**

(a) Answer: y = 36/x

(b) sets up 6 = 36/x oe	**M1**
(b) x = 6 cao	**A1**

(b) Answer: x = 6

Question 7

new x identified as 1.2x oe	**M1**
$(1.2)^3$ (= 1.728) calculated and applied to y oe	**M1**
72.8% (increase) cao (awrt 72.8)	**A1**

Answer: 72.8% increase

Question 8

overall scale factor for x identified as 2 x 3 (= 6) oe	**M1**
new y = $k(6x)^2$ = $36kx^2$ formed	**M1**
= 36y stated (cso, dependent on both M marks)	**A1**

Answer: y is multiplied by 36 (shown)

Question 9

(a) substitute P=480, m=12, h=8 into P = c m / h and rearrange	**M1**
(a) c = 320 cao	**A1**

(a) Answer: c = 320

(b) find new m = 1.5 * 12 = 18 and new h = 0.8 * 8 = 6.4	**M1**
(b) substitute into P = 320 * 18 / 6.4	**M1**
(b) P = 900 cao	**A1**

(b) Answer: 900 items

(c) rearrange P = c m / h to m = P h / c and substitute P=900, h=8, c=320	**M1**
(c) calculate m = 900 * 8 / 320 = 7200 / 320 = 22.5	**M1**
(c) m = 23 machines, since machines must be whole and 22 machines produce only 22 * 320 / 8 = 880 < 900 so round up	**A1**

(c) Answer: 23 machines. Calculation gives 22.5, so at least 23 machines are needed; rounding up because machines must be whole.

Question 10

(a) k = 36 cao	**B1**

(a) Answer: k = 36

(b) rearrange x = k / y^2 to y^2 = k / x or equivalent	**M1**
(b) take positive square root for y: y = $\sqrt{k / x}$	**M1**
(b) y = $\sqrt{k/x}$ cao	**A1**

(b) Answer: y = $\sqrt{k / x}$

(c) y = 6 cao	**B1**

(c) Answer: y = 6

© Revision Library | revisionlibrary.co.uk

Question 11

(a) new speed = v - 4 cao **B1**

(a) Answer: v - 4

(b) use fixed distance d = vt and write new time = vt / (v - 4) **M1**

(b) set vt/(v-4) = t + 1/4, multiply both sides by (v-4) and expand the right-hand side **M1**

(b) correctly cancel the vt terms and rearrange to reach 16t = v - 4 cao **A1**

(b) Answer: 16t = v - 4 (shown).

(c) rearrange 16t = v - 4 to make v the subject **M1**

(c) v = 16t + 4 cao **A1**

(c) substitute t = 1.5 into v = 16t + 4 **M1**

(c) v = 28 mph cao **A1**

(c) Answer: v = 16t + 4. When t = 1.5, v = 16(1.5) + 4 = 28 mph.

© Revision Library | revisionlibrary.co.uk