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And & Or Rules

Worked Solutions

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Full worked solutions for the free And & Or Rules worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the And & Or Rules worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

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Page 1 of 6

A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 Mutually exclusive, so add: $\frac{1}{4} + \frac{1}{3} = \frac{3}{12} + \frac{4}{12} = \boxed{\frac{7}{12}}$

A2 Independent, so multiply: $0.2 \times 0.15 = \boxed{0.03}$

A3 $P(\text{no rain on either day}) = 0.6 \times 0.6 = 0.36$ $1 - 0.36 = \boxed{0.64}$

HIGHER

A4 $\frac{3}{8} \times \frac{2}{7} = \boxed{\frac{6}{56} = \frac{3}{28}}$

A5 Maths not English: $0.9 \times 0.2 = 0.18$ English not maths: $0.1 \times 0.8 = 0.08$ $0.18 + 0.08 = \boxed{0.26}$

A6 $0.6 \times 0.25 = 0.15$, which equals $P(A \cap B)$ **Yes, independent**

A7 $\left(\frac{5}{n}\right)^2 = \frac{1}{16}$, so $\frac{5}{n} = \frac{1}{4}$ $\boxed{n = 20}$

B**Fluency solutions**One mark for each correct part. The notes in *italics* explain why each sequence was chosen.**FOUNDATION**

B1 (a) $\boxed{0.55}$ (b) $\boxed{0.65}$ (c) $\boxed{0.7}$ (d) $1 - 0.3 = \boxed{0.7}$

(c) and (d) are the same event: not D means A, B or C

B2 (a) $\boxed{0.2}$ (b) $\boxed{0.09}$ (c) $\boxed{\frac{1}{12}}$ (d) $\boxed{0.01}$



B3 (a) $\left(\frac{1}{6}\right)^2 = \frac{1}{36}$ (b) $\left(\frac{5}{6}\right)^2 = \frac{25}{36}$ (c) $1 - \frac{25}{36} = \frac{11}{36}$ (d) $\frac{1}{216}$

B4 (a) $0.1 \times 0.25 = 0.025$ (b) $0.9 \times 0.75 = 0.675$ (c) $1 - 0.675 = 0.325$ (d) $0.1 \times 0.75 + 0.9 \times 0.25 = 0.3$

Check: exactly one + both = $0.3 + 0.025 = 0.325$, which is at least one.

B5 (a) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ (b) $\frac{1}{6} + \frac{1}{6} = \frac{1}{3}$ (c) 6, 8, 10: $\frac{3}{10}$

In (c) the two conditions are on one card, and they are not independent, so count instead of multiplying.

B6 (a) 0.12 (b) $0.12 \times 200 = 24$ (c) $1 - 0.7 \times 0.6 = 0.58$ (d) 116

HIGHER

B7 (a) $\frac{3}{10} \times \frac{2}{9} = \frac{1}{15}$ (b) $\frac{7}{10} \times \frac{6}{9} = \frac{7}{15}$ (c) $\frac{1}{15} + \frac{7}{15} = \frac{8}{15}$ (d) $\frac{3}{10} \times \frac{7}{9} = \frac{7}{30}$

B8 (a) $\frac{1}{8}$ (b) HHT, HTH, THH: $\frac{3}{8}$ (c) $1 - \frac{1}{8} = \frac{7}{8}$ (d) $3 \times \frac{1}{6} \times \left(\frac{5}{6}\right)^2 = \frac{75}{216} = \frac{25}{72}$

"Exactly one" can happen in 3 positions, so multiply by 3.

B9 (a) $0.4 \times 0.5 = 0.2$: yes (b) $0.2 \neq 0.25$: no (c) 0.18: yes (d) $P(A \cap B) = 0.6 + 0.5 - 0.8 = 0.3 = 0.6 \times 0.5$: yes

B10 (a) $\sqrt{0.09} = 0.3$ (b) $0.24 \div 0.6 = 0.4$ (c) $(1 - p)^2 = 0.25$, $1 - p = 0.5$: 0.5 (d) $\frac{3}{n} = \frac{1}{5}$: 15

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 Getting a 6 on the first dice and on the second are not mutually exclusive, so you cannot add: two 6s would be counted twice.

$$1 - \frac{5}{6} \times \frac{5}{6} = \frac{11}{36}$$



C2 A 2 is also an even number, so the events overlap and cannot simply be added. Even numbers already include 2 $\frac{3}{6} = \frac{1}{2}$

C3 For both days (AND) you multiply, not add. Adding would give more than 1 for a probability above 0.5
 $0.3 \times 0.3 = 0.09$

C4 $P(\text{no heads}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$ $P(\text{at least one head}) = 1 - \frac{1}{8} = \frac{7}{8}$, as required

HIGHER

C5 The first counter is not put back, so there are only 3 red counters left out of 9 $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90} = \frac{2}{15}$

C6 $P(A \cap B) = 0.5 + 0.4 - 0.8 = 0.1$ $P(A) \times P(B) = 0.2$ $0.1 \neq 0.2$, so not independent, as required

C7 $P(\text{neither}) = (1 - p)^2$, so $P(\text{at least one}) = 1 - (1 - p)^2 = 1 - (1 - 2p + p^2) = 2p - p^2$ **proved**

C8 (a) Exactly one $= x(1 - x - 0.1) + (1 - x)(x + 0.1) = 0.9x - x^2 + 0.9x + 0.1 - x^2 = 0.5$
 $-2x^2 + 1.8x - 0.4 = 0 \quad \div(-2): x^2 - 0.9x + 0.2 = 0$ **as required**

(b) $(x - 0.4)(x - 0.5) = 0$ $x = 0.4$ or $x = 0.5$ Both give probabilities between 0 and 1

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 $P(\text{win}) = 0.4 \times 0.4 = 0.16$ $0.16 \times 50 = 8$

D2 $P(\text{both fail}) = 0.1 \times 0.1 = 0.01$ $P(\text{system works}) = 1 - 0.01 = 0.99$ $0.99 > 0.98$, so **yes**, it is more reliable

D3 (a) $0.8^3 = 0.512$ (b) $0.2^3 = 0.008$

D4 Red A and blue B: $0.3 \times 0.4 = 0.12$ Blue A and red B: $0.7 \times 0.6 = 0.42$ $0.12 + 0.42 = 0.54$



HIGHER

D5 Red: $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$ Blue: $\frac{3}{10} \times \frac{2}{9} = \frac{6}{90}$ Green: $\frac{6}{90}$ $\frac{24}{90} = \frac{4}{15}$

D6 Only A: $0.5 \times 0.6 \times 0.7 = 0.21$ Only B: $0.5 \times 0.4 \times 0.7 = 0.14$ Only C: $0.5 \times 0.6 \times 0.3 = 0.09$ **0.44**

D7 $P(\text{at least one 6}) = 1 - \left(\frac{5}{6}\right)^n$. We need $\left(\frac{5}{6}\right)^n < 0.1$

$n = 12: 0.112\dots$ $n = 13: 0.0934\dots$ **$n = 13$**

D8 Red then blue, or blue then red: $2 \times \frac{x}{x+3} \times \frac{3}{x+2} = \frac{1}{2}$

$12x = (x+3)(x+2) = x^2 + 5x + 6$ $x^2 - 7x + 6 = 0$ $(x-1)(x-6) = 0$ **$x = 1$** or **$x = 6$**

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1 (a) **0.55** B1

(b) **0.45** B1

E2 (a) **$\frac{1}{12}$** B1

(b) 0.2×0.4 M1

0.08 A1

E3 (a) **0.01** B1

(b) 0.9×0.9 M1

0.81 A1

E4 Primes: 2, 3, 5, 7, 11, 13, 17, 19 (8 numbers) M1

Multiples of 10: 10, 20. None of them is prime, so add M1

$\frac{10}{20} = \frac{1}{2}$ A1



- E5** (a) $1 - 0.2 - 0.35 - 0.15 = 0.3$ B1
 (b) 0.35×0.35 M1
 0.1225 A1

- E6** Ali only: $0.8 \times 0.4 = 0.32$ M1
 Ben only: $0.2 \times 0.6 = 0.12$ M1
 0.44 A1

HIGHER

- E7** $\frac{5}{8} \times \frac{4}{7}$ M2
 $\frac{20}{56} = \frac{5}{14}$ A1

- E8** (a) $P(A) \times P(B) = 0.4 \times 0.5 = 0.2$ M1
 This equals $P(A \cap B)$, so they are independent C1
 (b) $0.4 + 0.5 - 0.2$ M1
 0.7 A1

- E9** One way: $0.3 \times 0.7 \times 0.7 = 0.147$ M1
 The rainy day can be any of 3 days M1
 3×0.147 M1
 0.441 A1

- E10** (a) $\frac{6}{n} \times \frac{5}{n-1} = \frac{1}{3}$ M1
 $\frac{30}{n(n-1)} = \frac{1}{3}$ M1
 $90 = n^2 - n$, so $n^2 - n - 90 = 0$ as required A1
 (b) $(n-10)(n+9) = 0$ M1
 10 (a number of counters cannot be negative) A1

