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GCSE MATHEMATICS • PROBABILITY

Tree Diagrams

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Full worked solutions for the free Tree Diagrams worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Tree Diagrams 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.

Question sheet

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A**Your turn answers**

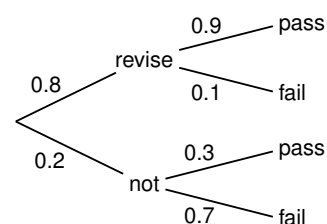
Compare each line of your working with the solution.

FOUNDATION

A1 Branches: $H \frac{1}{2}$, then not $6 \frac{5}{6}$ $\frac{1}{2} \times \frac{5}{6} = \frac{5}{12}$

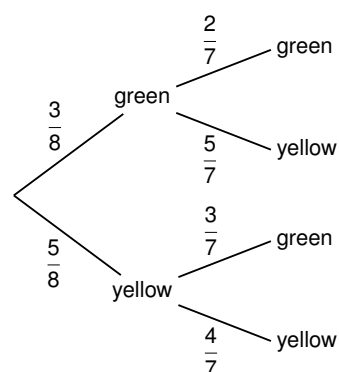
A2 $0.7 \times 0.8 + 0.3 \times 0.2 = 0.56 + 0.06 = 0.62$

A3 Revise then pass: $0.8 \times 0.9 = 0.72$
 Not revise then pass: $0.2 \times 0.3 = 0.06$
 $0.72 + 0.06 = 0.78$

**HIGHER**

A4 After a green, 2 green of 7 are left; after a yellow, 3 green of 7.

$$\frac{3}{8} \times \frac{2}{7} + \frac{5}{8} \times \frac{3}{7} = \frac{6}{56} + \frac{15}{56} = \frac{21}{56} = \frac{3}{8}$$



A5 $\frac{0.72}{0.78} = \frac{12}{13}$

A6 $0.6y + 0.4 \times 0.3 = 0.42$ $0.6y = 0.3$ $y = 0.5$



B**Fluency solutions**

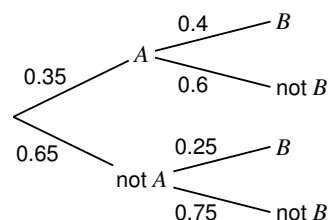
One mark for each correct part. The notes in *italics* explain why each sequence was chosen.

FOUNDATION

B1 (a) 0.65 (b) 0.4 (c) 0.75

(d) $0.35 \times 0.4 = 0.14$

Branches from one point add to 1; along a path you multiply.



B2 (a) 0.09 (b) 0.49 (c) $0.09 + 0.49 = 0.58$ (d) $1 - 0.58 = 0.42$

B3 (a) $\frac{4}{25}$ (b) $\frac{9}{25}$ (c) $\frac{6}{25}$ (d) $\frac{6}{25} + \frac{6}{25} = \frac{12}{25}$

With replacement, the second branches are the same as the first.

B4 (a) $0.3 \times 0.4 = 0.12$ (b) $0.7 \times 0.1 = 0.07$ (c) 0.19 (d) 0.81

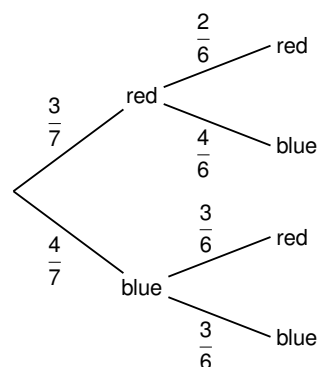
B5 (a) $0.19 \times 200 = 38$ (b) $0.12 \times 200 = 24$ (c) 162

B6 After one counter is taken, 6 are left.

(a) $\frac{2}{6}$ (b) $\frac{4}{6}$ (c) $\frac{3}{6}$

(d) $\frac{3}{7} \times \frac{2}{6} = \frac{6}{42} = \frac{1}{7}$

Without replacement, the second branches change.



HIGHER

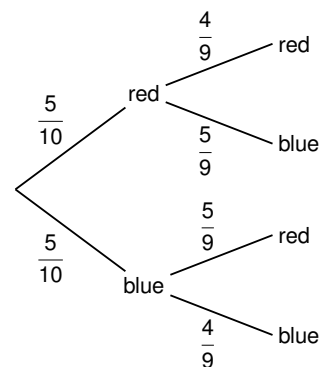
B7 (a) $\frac{4}{9}$ and $\frac{5}{9}$

(b) $\frac{5}{10} \times \frac{4}{9} = \frac{2}{9}$

(c) $\frac{20}{90} + \frac{20}{90} = \frac{4}{9}$

(d) $\frac{5}{10} \times \frac{4}{9} + \frac{5}{10} \times \frac{5}{9} = \frac{1}{2}$

Before you look, the second counter is as likely to be red as the first.



B8 (a) $\frac{0.12}{0.19} = \frac{12}{19}$ (b) $\frac{0.07}{0.19} = \frac{7}{19}$ (c) $\frac{0.18}{0.81} = \frac{2}{9}$ (d) read the branch: 0.4

Going backwards, divide by the probability of what you are told.

B9 (a) $0.7^3 = 0.343$ (b) $0.3^3 = 0.027$ (c) three ends, each 0.7×0.3^2 : 0.189 (d) $1 - 0.027 = 0.973$

B10 (a) $\sqrt{0.16} = 0.4$ (b) $0.5p + 0.15 = 0.4$: 0.5 (c) $0.6x + 0.1(1 - x) = 0.3$, $0.5x = 0.2$: 0.4 (d) $\frac{2}{n} \times \frac{1}{n-1} = \frac{1}{15}$, $n(n-1) = 30$: 6

C

Reasoning solutions

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

FOUNDATION

C1 The branches from one point cover every outcome, so they must add up to 1. $0.4 + 0.5 = 0.9$

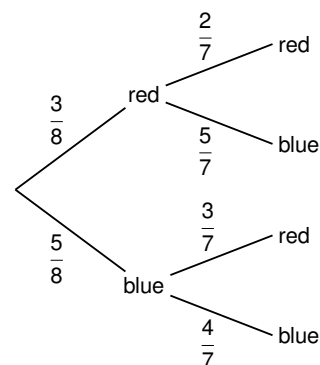
C2 For red AND red you multiply along the branches, not add. $0.3 \times 0.3 = 0.09$



- C3** (a) Ali used the same probabilities on the second branches, as if the first counter were put back. It is not replaced, so 7 counters are left.

(b) After red: red $\frac{2}{7}$, blue $\frac{5}{7}$

After blue: red $\frac{3}{7}$, blue $\frac{4}{7}$



- C4** $0.12 + 0.28 + 0.18 + 0.42 = 1$ as required (the first two ends add to 0.4, the last two to 0.6)

HIGHER

- C5** $P(\text{second red}) = \frac{3}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{3}{4} = \frac{12}{20}$ $P(\text{both red}) = \frac{6}{20}$

$P(\text{first red, given second red}) = \frac{6}{12} = \frac{1}{2}$, not $\frac{3}{5}$

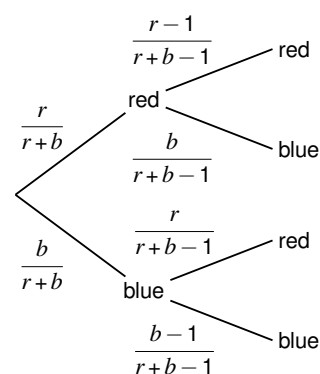
- C6** $\frac{4}{10} \times \frac{3}{9} + \frac{6}{10} \times \frac{4}{9} = \frac{12}{90} + \frac{24}{90} = \frac{36}{90} = \frac{4}{10}$, as required

- C7** The B ends are pq and $(1-p)r$. $P(B) = pq + (1-p)r = pq + r - pr = r + p(q-r)$ proved

- C8** (a) $P(\text{second red})$

$$= \frac{r}{r+b} \times \frac{r-1}{r+b-1} + \frac{b}{r+b} \times \frac{r}{r+b-1}$$

$$= \frac{r(r-1+b)}{(r+b)(r+b-1)} = \frac{r}{r+b}$$
proved



- (b) Before any counters are seen, each position is equally likely to hold any counter, so the third is red with probability $\frac{7}{20}$, as for the first.



D**Problem solving solutions**

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

FOUNDATION

D1 $P(\text{win}) = \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$, so about 10 wins in 120 games

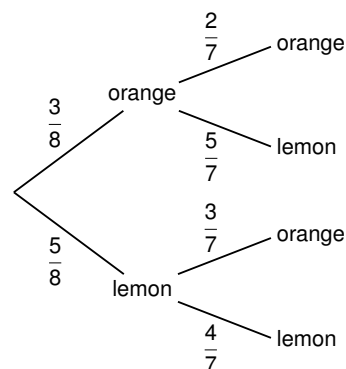
In: $120 \times 0.50 = £60$ Out: $10 \times 5 = £50$ Profit = **£10**

D2 At least 4 points: WW (6), WD (4), DW (4)

$0.5 \times 0.5 + 0.5 \times 0.2 + 0.2 \times 0.5 = 0.25 + 0.1 + 0.1 = \mathbf{0.45}$

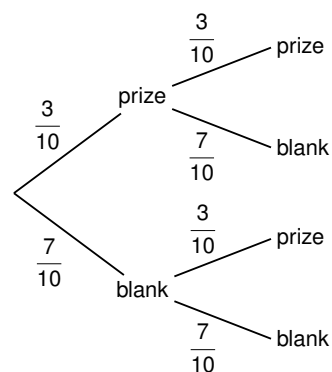
D3 (a) See the tree: 8 sweets, then 7 after one is eaten.

(b) $\frac{3}{8} \times \frac{5}{7} + \frac{5}{8} \times \frac{3}{7} = \frac{30}{56} = \mathbf{\frac{15}{28}}$



D4 (a) See the tree (with replacement, so every pair is $\frac{3}{10}$ and $\frac{7}{10}$).

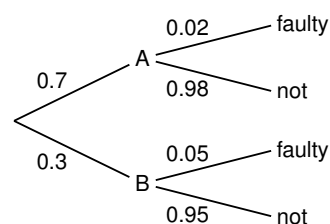
(b) $1 - \frac{7}{10} \times \frac{7}{10} = 1 - 0.49 = \mathbf{0.51}$

**HIGHER**

D5 (a) B: 0.3; not faulty after A: 0.98; after B: faulty 0.05, not 0.95

(b) A and faulty: 0.014 B and faulty: 0.015

$\frac{0.014}{0.029} = \mathbf{\frac{14}{29}}$



D6 One order, e.g. R, B, G: $\frac{5}{10} \times \frac{3}{9} \times \frac{2}{8} = \frac{30}{720}$ There are 6 orders $\frac{180}{720} = \boxed{\frac{1}{4}}$

D7 (a) $P(\text{misses all three}) = 0.6^3 = 0.216$ $1 - 0.216 = \boxed{0.784}$

(b) Miss, miss, hit: $0.6 \times 0.6 \times 0.4 = \boxed{0.144}$

D8 (a) Win the second game: $0.6p + 0.4(p - 0.2) = 0.5$ $p - 0.08 = 0.5$ $\boxed{p = 0.58}$

(b) $\frac{0.6 \times 0.58}{0.5} = \frac{0.348}{0.5} = \boxed{0.696}$

E**Exam practice solutions**

Marks are shown on the right of each line.

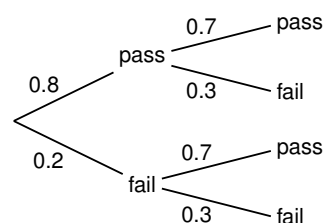
FOUNDATION

Foundation and Higher crossover

E1 (a) See the tree.

(b) $0.8 \times 0.7 = \boxed{0.56}$

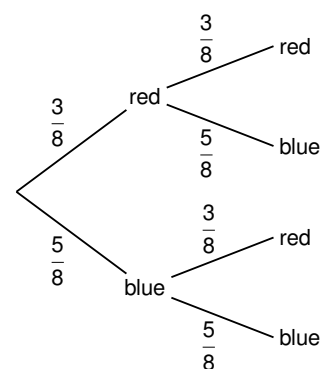
(c) $0.8 \times 0.3 + 0.2 \times 0.7 = 0.24 + 0.14 = \boxed{0.38}$



B2 B1 B1

E2 (a) See the tree.

(b) $\frac{3}{8} \times \frac{5}{8} + \frac{5}{8} \times \frac{3}{8} = \frac{30}{64} = \boxed{\frac{15}{32}}$



B1 M1 A1



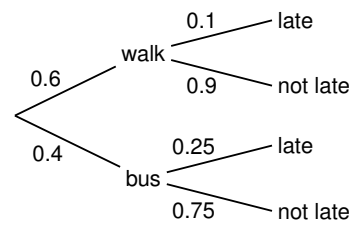
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E3 Walk and late: $0.6 \times 0.1 = 0.06$

Bus and late: $0.4 \times 0.25 = 0.1$

$$0.06 + 0.1 = \boxed{0.16}$$

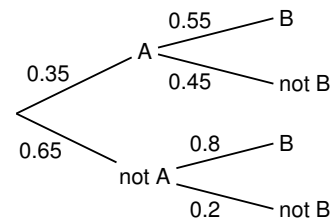


M1 M1 A1

E4 Not A: $\boxed{0.65}$

B after A: $\boxed{0.55}$

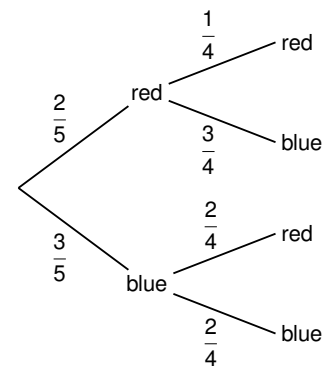
Not B after not A: $\boxed{0.2}$



B2

E5 (a) See the tree: 5 counters, then 4 left.

(b) $\frac{3}{5} \times \frac{2}{4} = \frac{6}{20} = \boxed{\frac{3}{10}}$



B2 B1

E6 $P(\text{no red}) = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$

$$1 - \frac{9}{16}$$

$$\boxed{\frac{7}{16}}$$

M1

M1

A1



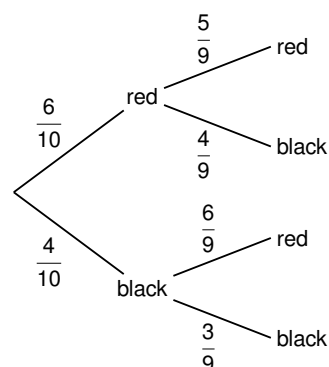
HIGHER

E7 (a) See the tree.

(b) Red, red: $\frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$

Black, black: $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$

$\frac{42}{90} = \frac{7}{15}$



B2 M1 A1

E8 P(late) = 0.16 from E3

P1

P(walk and late) = 0.06

P1

$\frac{0.06}{0.16}$

M1

$\frac{3}{8}$

A1

E9 One order, R, R, Y: $\frac{4}{9} \times \frac{3}{8} \times \frac{5}{7} = \frac{60}{504}$

M1

Three orders: RRY, RYR, YRR

M1

$3 \times \frac{60}{504} = \frac{180}{504}$

M1

$\frac{5}{14}$

A1

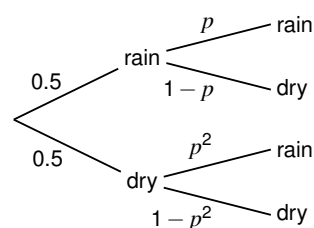
E10 (a) $0.5p + 0.5p^2 = 0.28$

$\times 2: p^2 + p - 0.56 = 0$

as required

(b) $(p - 0.4)(p + 1.4) = 0$, and $p \geq 0$, so $p = 0.4$

(c) $\frac{0.5 \times 0.4}{0.28} = \frac{0.2}{0.28} = \frac{5}{7}$



M1 A1 B1 M1 A1

