



eClassroom

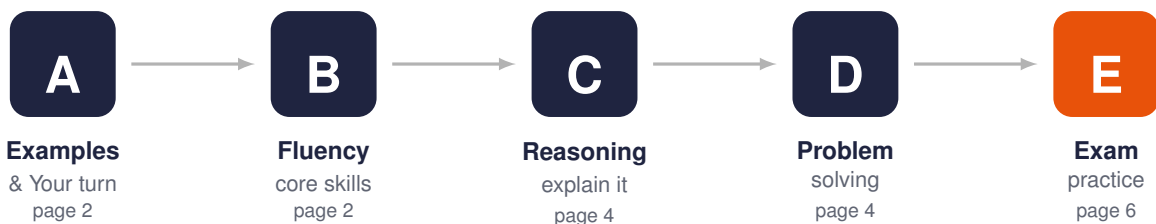
A-LEVEL MATHEMATICS • STATISTICS 1

Probability

Worked Solutions

Pearson Edexcel International A Level (WST01) & A Level (9MA0) • Calculator and statistical tables allowed: show every step

Full worked solutions for the free Probability worksheet, A-Level and International A-Level Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Statistics 1 Probability 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. At A-level most marks are for method, so a wrong final answer can still earn most of the marks. 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, **dM** = method mark that depends on the previous M mark, **A** = accuracy mark (needs the M mark before it), **B** = independent mark.

Question sheet

Exam questions by topic

Statistics 1 exam questions

More worksheets



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A**Your turn answers**

Compare each line of your working with the solution.

CORE

A1 Both 12, T only 14, C only 18; neither $60 - 44$: **16**; $P(T|C) = \frac{12}{30} = \frac{2}{5}$

A2 $0.35 + 0.45 - 0.6$: **0.2**; $0.35 - 0.2$: **0.15**

A3 $\frac{5}{8} \times \frac{4}{7} + \frac{3}{8} \times \frac{2}{7} = \frac{20}{56} + \frac{6}{56}$: **$\frac{13}{28}$**

STRETCH

A4 $P(A \cap B) = 0.4 + 0.5 - 0.75 = 0.15$, but $0.4 \times 0.5 = 0.2$: **not independent**

A5 $\frac{0.4 \times 0.1}{0.4 \times 0.1 + 0.6 \times 0.05} = \frac{0.04}{0.07}$: **0.571**

A6 (i) $0.5 - 0.2$: **0.3**; (ii) $0.2 + p - 0.2p = 0.5$, $0.8p = 0.3$: **0.375**

A7 $x = 0.25(0.36 + x)$, so $0.75x = 0.09$: **$x = 0.12$**

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

B1 (a) $45 - 12$: **33** (b) $80 - 63$: **17** (c) $\frac{18}{80}$: **$\frac{9}{40}$** (d) $\frac{12}{30}$: **$\frac{2}{5}$**

For a conditional, the total becomes the number in the given set.

B2 (a) $0.5 + 0.35 - 0.2$: **0.65** (b) **0.5** (c) $0.5 - 0.2$: **0.3** (d) $1 - 0.65$: **0.35**

Sketch the Venn diagram once, then read every part from it.

B3 (a) 0.8 (b) 0.3×0.5 : 0.15 ; $0.8 - 0.15$: 0.65 (c) $\frac{0.15}{0.5}$: 0.3

(d) Mutually exclusive needs $P(A \cap B) = 0$, but independence gives 0.15 : **they cannot be both**

The same two events behave very differently under the two conditions.

B4 (a) $0.6(0.1) + 0.4(0.25)$: 0.16 (b) 0.6×0.9 : 0.54 (c) $\frac{0.1}{0.16}$: 0.625 (d) 0.84

Multiply along branches; add across the routes that give the event.

CORE

B5 (a) $\frac{40}{100}$: 0.4 (b) $\frac{24}{60}$: 0.4 (c) **yes**: $P(\text{sport} | Y12) = P(\text{sport})$

Equal conditional and unconditional probabilities mean independence.

B6 (a) $\frac{5}{12} \times \frac{4}{11}$: $\frac{5}{33}$ (b) $\frac{20+12+6}{132}$: $\frac{19}{66}$ (c) $1 - \frac{9}{12} \times \frac{8}{11}$: $\frac{5}{11}$ (d) $\frac{47}{66}$

"At least one" and "different" are quickest by complements.

STRETCH

B7 Only: N 29, S 21, P 14; pairs only 9, 6, 4; all 6

(a) $100 - 89$: 11 (b) 0.64 (c) $\frac{15}{50}$: 0.3 (d) $0.15 \neq 0.5 \times 0.4$: **not independent**

Fill a three-set diagram from the centre: all three, then each pair, then each set.

B8 (a) $x + 0.4 - 0.4x = 0.7$: 0.5 (b) 0.2 (c) $\frac{0.3}{0.6}$: 0.5 (d) $1 - 0.7$: 0.3

For independent events, conditioning on B' leaves $P(A)$ unchanged too.

B9 (a) $0.7^2 \times 0.3$: 0.147 (b) $1 - 0.7^3$: 0.657 (c) $3 \times 0.3 \times 0.7^2$: 0.441 (d) $\frac{0.147}{0.657}$: 0.224

"First hit on the third" needs both earlier misses.

B10 (a) $0.01 + 0.009 + 0.01$: 0.029 (b) $\frac{0.01}{0.029}$: 0.345 (c) $\frac{0.49}{0.971}$: 0.505

(d) **A and C are equally likely** (0.01 each), more than B (0.009)

A big supplier with a low fault rate can match a small supplier with a high one.



C

Reasoning solutions

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

CORE

C1 Overlapping is not the test. $0.5 \times 0.4 = 0.2 = P(A \cap B)$: **A and B are independent**

C2 She divided by $P(A)$; the condition is B : $\frac{0.1}{0.4} = \mathbf{0.25}$

C3 The beads are not replaced, so the second probability changes: $\frac{3}{10} \times \frac{2}{9} = \mathbf{\frac{1}{15}}$

C4 She has one route only; black then white also gives exactly one white: $2 \times \frac{3}{10} \times \frac{7}{9} = \mathbf{\frac{7}{15}}$

STRETCH

C5 $P(C \cap D) = P(C)P(D)$ only if they are independent, which is not given.

$$P(C \cap D) = P(C|D)P(D) = 0.3 \times 0.4 = \mathbf{0.12}$$

C6 He assumed mutually exclusive events. $P(C) = 0.65 - 0.4 + 0.15 = \mathbf{0.4}$

C7 Her second roll is the third roll overall: she and the other player must both miss first.

$$\frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = \mathbf{\frac{25}{216}}$$

C8 (a) $P(A \cap B') = P(A) - P(A \cap B) = P(A) - P(A)P(B) = P(A)(1 - P(B)) = \mathbf{P(A)P(B')}$

(b) Independent: $P(A \cap B) = P(A)P(B) > 0$; mutually exclusive: $P(A \cap B) = 0$: **both cannot hold**

D

Problem solving solutions

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

CORE

D1 (a) $1 - 0.18 - 0.12 - 0.4$: $\mathbf{x = 0.3}$

(b) $\frac{0.12}{0.12 + 0.3} = \frac{0.12}{0.42}$: $\mathbf{\frac{2}{7}}$



D2 (a) $E': 0.6; S' | E: 1 - p; S' | E': 0.85$

(b) $0.4p + 0.6 \times 0.15 = 0.13$, so $0.4p = 0.04$: $p = 0.1$

(c) $\frac{0.04}{0.13}$: 0.308

D3 (a) $\frac{6+4+7+3}{80}$: 0.25

(b) pool: $18 + 6 + 7 + 3 = 34$; pool and courts: $7 + 3 = 10$: $\frac{5}{17}$

D4 $P(A \cap B) = 0.4y$: $x + y - 0.4y = 0.62$ and $x - 0.4y = 0.12$

Subtracting: $y = 0.5$, then $x = 0.12 + 0.2$: $x = 0.32, y = 0.5$

STRETCH

D5 (a) $B: \frac{n}{n+6}, W: \frac{6}{n+6}$; then $\frac{n-1}{n+5}, \frac{6}{n+5}$ after B, and $\frac{n}{n+5}, \frac{5}{n+5}$ after W

(b) $\frac{6}{n+6} \times \frac{5}{n+5} = \frac{1}{7}$, so $(n+6)(n+5) = 210$, $n^2 + 11n + 30 = 210$: $n^2 + 11n - 180 = 0$

(c) $(n+20)(n-9) = 0$: **9 blue sweets**

D6 (a) $0.15 + p + 0.05 + 0.04 = 0.4$: $p = 0.16$; $q = 1 - 0.78$: $q = 0.22$

(b) $P(S) = 0.48$, $P(R)P(S) = 0.4 \times 0.48 = 0.192$, but $P(R \cap S) = 0.2$: **not independent**

D7 (a) $C: 0.1; O': 0.05, 0.2, 0.7$

(b) $0.6(0.95) + 0.3(0.8) + 0.1(0.3)$: 0.84

(c) $\frac{0.1 \times 0.7}{1 - 0.84} = \frac{0.07}{0.16}$: 0.4375

D8 (a) Red $\frac{n}{2}$, green $\frac{n}{3}$, blue $\frac{n}{6}$: $\frac{n/2}{n} \times \frac{n/3}{n-1} \times \frac{n/6}{n-2} = \frac{n^2}{36(n-1)(n-2)} = \frac{2}{55}$

$55n^2 = 72(n^2 - 3n + 2)$: $17n^2 - 216n + 144 = 0$

(b) $(17n - 12)(n - 12) = 0$; $n = \frac{12}{17}$ is not a whole number: **12 sweets**



E

Exam practice solutions

Mark-scheme notes are shown on the right of each line.

CORE

Exam questions for everyone

- E1** (a) all three 6; $F \cap G$ only 9, $F \cap S$ only 12, $G \cap S$ only 6 M1 A1
 F only 23, G only 19, S only 21: **outside 24** A1 A1
- (b) $P(F \cap S) = \frac{18}{120} = 0.15$; $P(F)P(S) = \frac{50}{120} \times \frac{45}{120} = 0.15625$ M1
not independent A1
- (c) $\frac{23 + 19 + 21}{120}$: **$\frac{21}{40}$** B1
- (d) $\frac{6 + 6}{45}$ M1
 $\frac{4}{15}$ A1
-
- E2** (a) **$Z: 0.2$; $D': 0.7, 0.6, 1 - p$** B1 B1
- (b) $0.45(0.3) + 0.35(0.4) + 0.2p = 0.335$ M1
 $0.2p = 0.06$: **$p = 0.3$** A1
- (c) $\frac{0.35 \times 0.4}{0.335} = \frac{0.14}{0.335}$ M1
0.418 A1
- (d) $2 \times 0.335 \times 0.665$ M1
0.446 A1
- (e) $P(X | D) = \frac{0.135}{0.335}$; both: $\left(\frac{0.135}{0.335}\right)^2$ M1
0.162 A1



STRETCH

- E3** (a) B and C are mutually exclusive B1
- (b) $P(B) = 0.25 + p$ and $P(A \cap B) = p$; independence: $p = 0.5(0.25 + p)$ M1 M1
 $0.5p = 0.125$: $p = 0.25$ A1
- (c) $q = P(C|A)P(A) = 0.2 \times 0.5$: $q = 0.1$ M1 A1
 $a = 0.5 - 0.25 - 0.1$: $a = 0.15$ A1
- (d) $P(B \cup C) = 0.25 + 0.25 + 0.1 + 0.15 = 0.75$; A' part: $0.25 + 0.15 = 0.4$ M1
 $\frac{0.4}{0.75}$: $\frac{8}{15}$ A1
- (e) $30 \div 0.1 = 300$ people; B only: 0.25×300 M1
 75 people A1
- (f) $P(A)P(C) = 0.5 \times 0.25 = 0.125 \neq 0.1$: not independent B1

