A-Level Starter Activity

Jethwa Maths

Topic: Probability Notation

Chapter Reference: Statistics 2, Chapter 2

8 minutes

1. For the events *A* and *B*,

P(*A* n *B*') = 0.32
P(*A*' n *B*) = 0.11
P(*A* u *B*) = 0.65

a. Draw a Venn diagram to illustrate the complete sample space for the events *A* and *B*. **(4)**

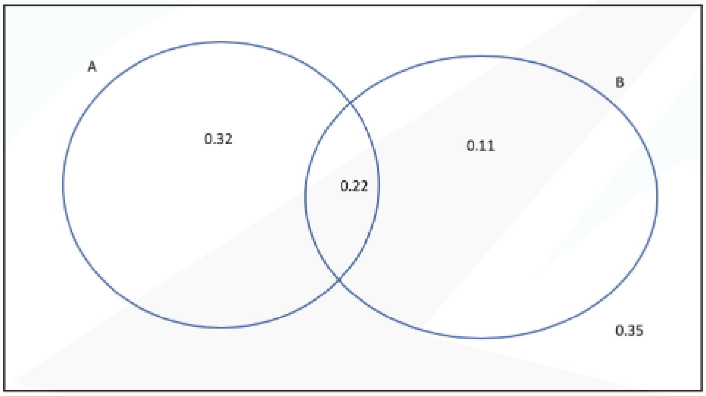
b. Write down the value of P(*A*) and the value of P(*B*) **(2)**

c. Find P(*A* I *B*') **(3)**

d. Determine whether or not *A* and *B* are independent **(4)**

<u>**Solutions**</u>

1a.



Two intersecting circles AND box	**M1**
0.32, 0.11	**M1**
0.22	**M1**
0.35 outside	**M1**

1b.

P(*A*) = 0.33 + 0.22 P(*A*) = 0.54	**M1**
P(*B*) = 0.11 + 0.22 P(*B*) = 0.33	**M1**

1c.

P(*B*') = 1 – 0.33 P(*B*') = 0.67	**M1**
P(*A* n *B*') = 0.32	**M1**
P(*A* I *B*') = $\frac{0.32}{0.67}$ P(*A* I *B*') = $\frac{32}{67}$	**M1**

1d.

P(*A*) = 0.54 P(*B*) = 0.33 P(*A* n *B*) = 0.54 x 0.33 = 0.178	**M1**
From Venn, P(*A* n *B*) = 0.22	**M1**
If independent P(*A*) x P(*B*) = P(*A* n *B*) 0.22 $\neq$ 0.178	**M1**
Therefore, *A* and *B* are not independent.	**M1**

A-Level Starter Activity

Jethwa Maths

Topic: Probability Formulae

Chapter Reference: Statistics 2, Chapter 2

8 minutes

1. The events A and B are such that P(A) = $\frac{2}{5}$, P(B) = $\frac{1}{2}$ and P(A I B') = $\frac{4}{5}$

a. Find P(A n B') **(2)**

b. Find P(A n B) **(2)**

c. Find P(A u B) **(2)**

d. P(A I B) **(2)**

e. State, with a reason, whether or not A and B are mutually exclusive. **(1)**

f. State, with a reason, whether or not A and B are independent. **(4)**

Solutions

1a.

P(B') = 1 - $\frac{1}{2} = \frac{1}{2}$	**M1**
P(A n B') = $\frac{4}{5} \times \frac{1}{2} = \frac{2}{5}$	**M1**

1b.

P(A n B) = $\frac{2}{5} - \frac{2}{5}$	**M1**
P(A n B) = 0	**M1**

1c.

P(A) =$\frac{2}{5}$ P(B) = $\frac{1}{2}$ P(A u B) = $\frac{2}{5} + \frac{1}{2} - 0$	**M1**
P(A u B) = $\frac{9}{10}$	**M1**

1d.

P(A I B) = $\frac{P(A\,n\,B)}{P(B)}$ As P(A n B) = 0	**M1**
P(A I B) = 0	**M1**

1e.

From b, we know that P(A n B) = 0, therefore the two events are mutually exclusive.	**M1**

1f.

P(A) = $\frac{2}{5}$ P(B) = $\frac{1}{2}$ P(A n B) = $\frac{2}{5} \times \frac{1}{2} = \frac{1}{5}$	**M1**
From b, P(A n B) = 0	**M1**
If independent, P(A) x P(B) = P(A n B) $\frac{1}{5} \neq 0$	**M1**
Therefore, A and B are no independent events	**M1**

Topic: Drawing Venn Diagrams Chapter Reference: Statistics 2, Chapter 2	8 minutes

1. Given that P(*A*) = 0.35 , P(*B*) = 0.45 and P(*A* n *B*) = 0.13

Find

a. P(*A* u *B*) **(2)**

b. P(*A*’ I *B*’) **(2)**

The event *C* has P(*C*) = 0.20 The events *A* and *C* are mutually exclusive and the events *B* and *C* are independent.

c. Find P(*B* n *C*) **(2)**

d. Draw a Venn diagram to illustrate the events *A*, *B* and *C* and the probabilities for each region. **(4)**

e. Find P([*B* u *C*]) **(2)**

Solutions

1a.

$P(A \text{ u } B) = 0.35 + 0.45 - 0.13$	**M1**
$= 0.67$	**M1**

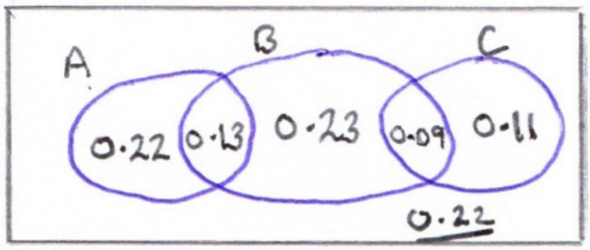
1b.

$P(A' \text{ I } B') = \frac{P(A' n\, B')}{P(B')} = \frac{0.33}{0.55}$	**M1**
$= \frac{3}{5}$	**M1**

1c.

$P(B \text{ n } C) = 0.45 \text{ x } 2$	**M1**
$= 0.09$	**M1**

1d.



Three intersecting circles	**M1**
0.22, 0.13, 0.23	**M1**
0.09, 0.11	**M1**
0.22 outside	**M1**

1e.

$P(B \text{ u } C') = 0.22 + 0.22$	**M1**
$= 0.44$	**M1**

Topic: Tree Diagrams

Chapter Reference: Statistics 2, Chapter 2

7 minutes

1. The employees of a company are classified as management, administration, or production. The following table shows the number of employees in each category and whether or not they live close to the company or some distance away.

	Live Close	Live some distance away
Management	6	14
Administration	25	10
Production	45	25

An employee is chosen at random. Find the probability that this employee,

a. Is an administrator **(2)**

b. Lives close to the company, given that the employee is a manager **(2)**

Of the managers, 90% are married, as are 60% of the administrators and 80% of the production employees.

c. Construct a tree diagram containing all the probabilities. **(3)**

d. Find the probability that an employee chosen at random is married **(2)**

An employee is selected at random and found to be married.

e. Find the probability that this employee is in production **(2)**

Solutions

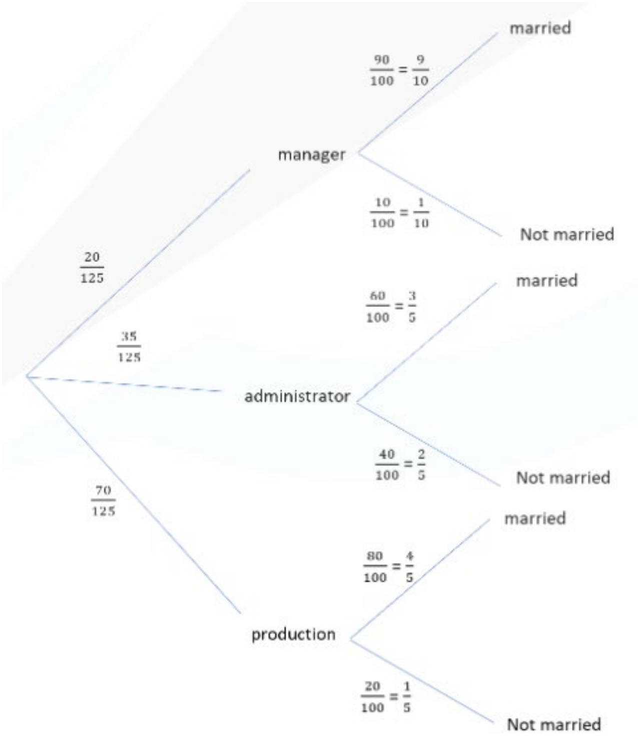
1a.

$P = \frac{35}{125}$	**M1**
$P = \frac{7}{25}$	**M1**

1b.

$P(A \text{ I } B) = \frac{\frac{6}{125}}{\frac{20}{125}}$	**M1**
$= \frac{6}{20} = \frac{3}{10}$	**M1**

1c.



Shape of branches and labels	**M1**
All three correct first event branch values	**M1**
All correct second event branch values	**M1**

1d.

$P = \frac{9}{10} \times \frac{21}{125} + \frac{3}{5} \times \frac{35}{125} + \frac{4}{5} \times \frac{70}{125}$	**M1**
P = 0.76	**M1**

1e.

$P(A \text{ I } B) = \frac{\frac{56}{125}}{0.76} = \frac{56}{0.76}$	**M1**
= 0.589	**M1**

A-Level Starter Activity

Jethwa Maths

Topic: Tree Diagrams

Chapter Reference: Statistics 2, Chapter 2

8 minutes

1. In a factory, machines A, B and C are all producing metal rods of the same length. Machine A produces 35% of the rods, machine B produces 25% and the rest are produced by machine C. Of their production of rods, machines A, B and C produce 3%, 6% and 5% defective rods respectively.

a. Draw a tree diagram to represent this information. **(3)**

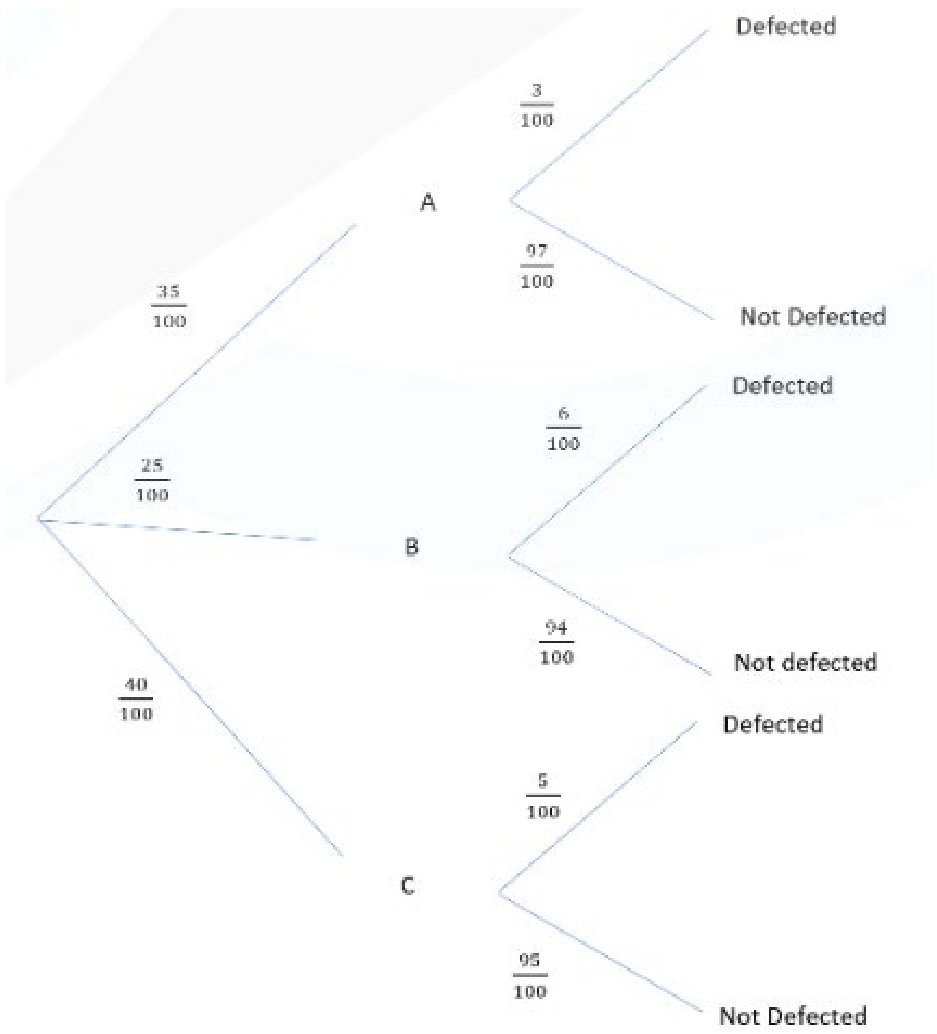
b. Find the probability that a randomly selected rod is produced by machine A and is defective. **(2)**

c. Find the probability that a randomly selected rod is defective. **(2)**

d. Give that a randomly selected rod is defective, find the probability that it was produced by machine C. **(3)**

Solutions

1a.



Overall shape and labels	**M1**
All correct event 1 probabilities	**M1**
All correct event 2 probabilities	**M1**

1b.

$P = \frac{35}{100} \times \frac{3}{100}$	**M1**
$= \frac{21}{2000}$ (= 0.0105)	**M1**

1c.

$P = \frac{3}{100} \times \frac{25}{100} + \frac{6}{100} \times \frac{35}{100} + \frac{5}{100} \times \frac{4}{100}$	**M1**
$P = \frac{91}{2000}$ (= 0.0455)	**M1**

1d.

$P(C \text{ n } D) = \frac{40}{100} \times \frac{5}{100} = \frac{200}{10000} = 1\frac{1}{50}$	**M1**
$P(C \text{ I } D) = \frac{\frac{1}{50}}{0.0455}$	**M1**
$= \frac{40}{91}$ (= 0.440)	**M1**