BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 4B

1

Draw a labelled mathematical diagram to model each of the following situations.

Note – Use capital letters for forces, e.g. ***W*** for weight, ***R*** for normal reaction, ***T*** for tension, ***F*** for friction. An unknown force of indeterminate cause is often called ***P*** or ***X***.

(a) A football of mass 0.5 kg resting on horizontal ground.
(b) A box of mass 12kg hanging from a vertical rope.
(c) A piece of space debris, drifting in interstellar space.
(d) A cup of tea of mass 100 g resting on a rough table which is sloping at an angle 30^o to the horizontal.
(e) A heavy box, being dragged at a constant speed along a rough horizontal floor by a rope which is at an angle 45^o to the horizontal.
(f) A book being pushed from rest across a smooth horizontal table by a finger which is at angle 30^o to the horizontal.
(g) A smooth ring hanging on a taut string either end of which is attached to two points equal distance from the ground.

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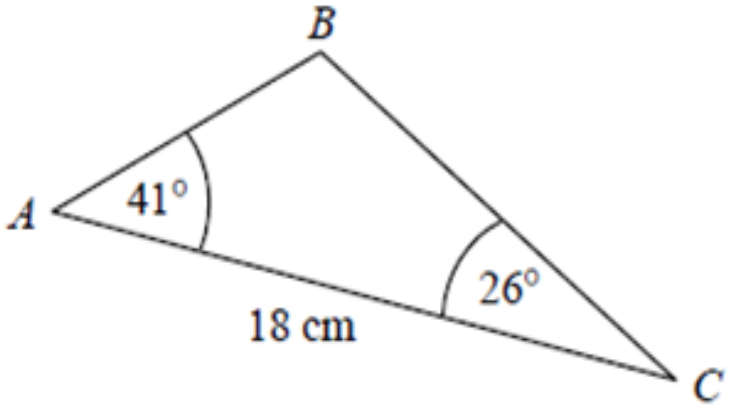
2

The diagram shows triangle ABC in which $AC = 18\text{cm}$, $\angle BAC = 41°$ and $\angle ACB = 26°$

Find to 3 significant figures:

(a) The length BC

(b) The area of triangle ABC.



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3

One plastic toy aeroplane is given away free in each packet of cornflakes. Equal numbers of red, yellow, green and blue aeroplanes are distributed in the packets. Faye, a customer, has so far collected three colours of aeroplane but still wants a yellow one. Henry, a quality controller employed by the cornflake manufacturer, opens a number of packets of cornflakes at random to check the distribution of the colours.

Find the probability that:

(a) Faye opens 4 more packets but fails to get a yellow aeroplane

(b) Faye gets her first yellow aeroplane in the 5^{th} packet she opens

(c) Henry opens two packets and gets aeroplanes of different colours

(d) Henry opens 4 packets and gets one aeroplane of each colour

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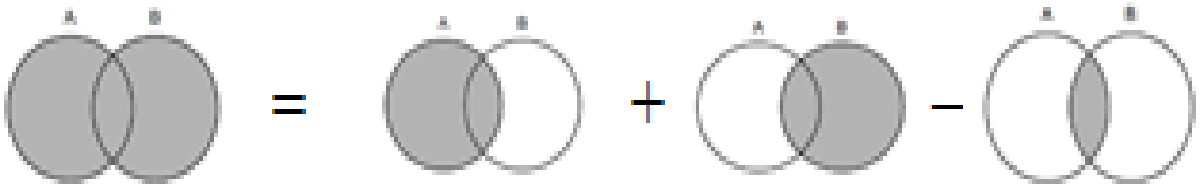
4

(a) If $P(A') = 0.7$, $P(B) = 0.5$ and $P(A \cap B) = 0.15$ find $P(A \cup B)$
(b) If $P(A') = 0.57$, $P(B) = 0.56$ and $P(A \cup B) = 0.77$ find $P(A \cap B)$
(c) If $P(A \cup B) = 0.85$, $P(B) = 0.35$ and $P(A \cap B) = 0.05$ find $P(A')$

$P(A')$ means the probability of 'not A' so $P(A') = 1 - P(A)$
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$



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A1 DOUBLES ASSIGNMENT 4B

5

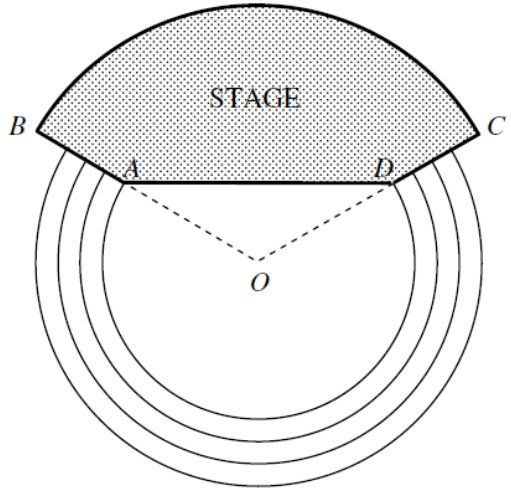
The two diagrams show an orchestral stage ABCD which is part of a circular sector OBC, centred at O and of radius 17m. The points A and D lie on OB and OC respectively so that $|OA| = |OD| = 12m$ and $|AD| = 20m$.

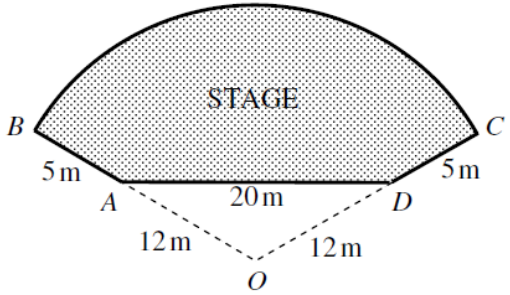
a) Show that angle BOC=1.97 radians, correct to 3 significant figures.

b) Calculate the area of the stage.

There are 4 rows of seats with their backs arranged in concentric circles, centred at O. The radii of these circles are 12m, 13.1m, 14.2m and 15.3m.

c) Given further that each seat requires a length of 83cm along the arc, find approximately how many more seats are in the back row than in the front row.





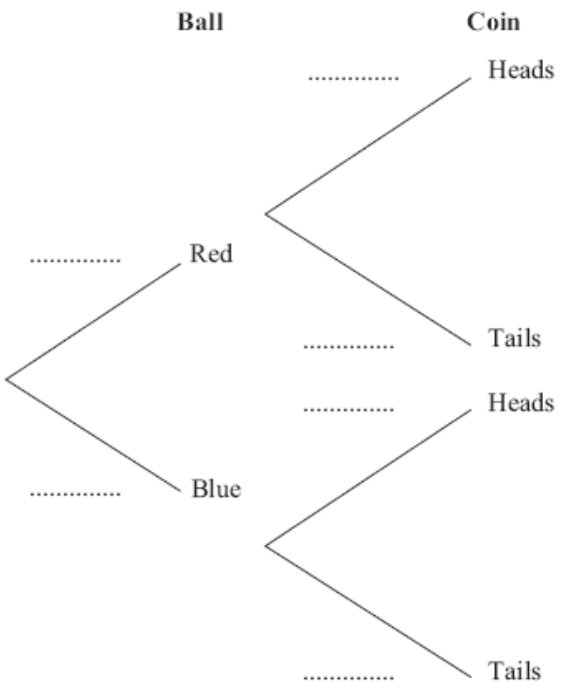
TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 4B

6

An experiment consists of selecting a ball from a bag and spinning a coin.
The bag contains 5 red balls and 7 blue balls. A ball is selected at random from the bag, its colour is noted and then the ball is returned to the bag.
When a red ball is selected, a biased coin with probability $\frac{2}{3}$ of landing on heads is spun.
When a blue ball is selected a fair coin is spun.

(*a*) Copy and complete the tree diagram to show the possible outcomes and associated probabilities.



TAP FOR ANSWERS

6

Shivani selects a ball and spins the appropriate coin.

(*b*) Find the probability that she obtains a head.

Given that Tom selected a ball at random and obtained a head when he spun the appropriate coin,

(*c*) find the probability that Tom selected a red ball.

Shivani and Tom each repeat this experiment.

(*d*) Find the probability that the colour of the ball Shivani selects is the same as the colour of the ball Tom selects.

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 4B

7

Two cars P and Q are moving in the same direction along the same straight horizontal road. Car P is moving with constant speed 25 m s^{-1}. At time $t = 0$, P overtakes Q which is moving with constant speed 20 m s^{-1}. From $t = T$ seconds, P decelerates uniformly, coming to rest at a point X which is 800 m from the point where P overtook Q. From $t = 25$ s, Q decelerates uniformly, coming to rest at the same point X at the same instant as P.

(a) Sketch, on the same axes, the speed-time graphs of the two cars for the period from $t = 0$ to the time when they both come to rest at the point X.

(b) Find the value of T.

TAP FOR ANSWERS

8

A child playing cricket on horizontal ground hits the ball towards a fence 10 m away. The ball moves in a vertical plane which is perpendicular to the fence. The ball just passes over the top of the fence, which is 2 m above the ground, as shown in Figure 3.

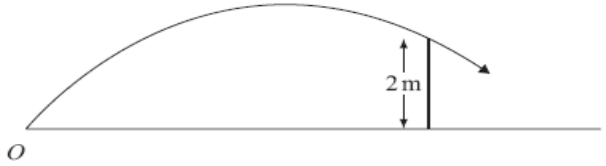


Figure 3

The ball is modelled as a particle projected with initial speed u m s^{-1} from point O on the ground at an angle α to the ground.

(a) By writing down expressions for the horizontal and vertical distances, from O of the ball t seconds after it was hit, show that $2 = 10\tan\alpha - \frac{50g}{u^2\cos^2\alpha}$

Given that $\alpha = 45°$,

(b) find the speed of the ball as it passes over the fence.

TAP FOR ANSWERS

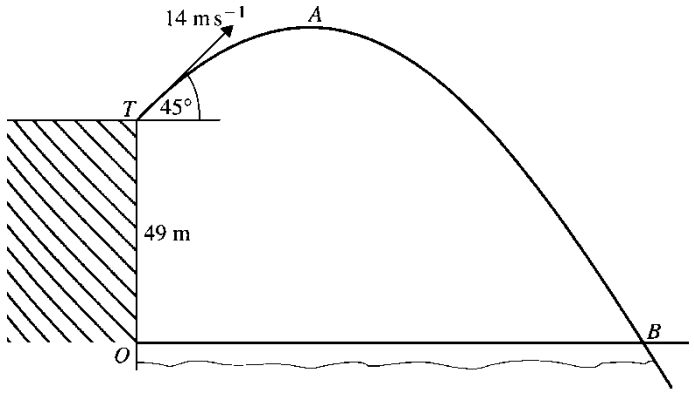
BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 4B

9

A golf ball is struck from the point T, at the top of a cliff which is 49m above sea level, with a speed of 14m/s at an angle of 45° to the horizontal, as shown in the diagram. The point O is at sea level and vertically below T. The point A is the highest point reached by the ball in its motion. The ball strikes the sea at the point B.

(a) Find the height A above sea level.

(b) Find the distance OB.



TAP FOR ANSWERS

10

A van is travelling at 14 ms^{-1} along a straight road. At time $t = 0$, the van passes a car, which then sets off from rest travelling in the same direction as the van. The car accelerates uniformly to a velocity of 18 ms^{-1} in 20 seconds, then maintains this speed.

Draw a velocity time graph to show the motion of the van and the car & use it to find the number of seconds after setting off that the car overtakes the van.

TAP FOR ANSWERS

11

(a) 20 pieces of data have been summarised as follows: $\sum(x+2)=7$ and $\sum(x+2)^2=80$.
Calculate the mean and standard deviation of the data.
(b) Find the interquartile range of this data set (data rounded to the nearest centimetre).

X	0-5	6-10	11-15	16-20
f	26	17	11	6

TAP FOR ANSWERS

12

A, B and C are 3 events such that:

$$P(A) = 0.4\,, P(B) = 0.3, P(C) = 0.25$$

and

$$P(A \cup B) = 0.6, P(B \cup C) = 0.55, P(A \cup C) = 0.65,$$

Which pairs of the events A, B and C are mutually exclusive?

TAP FOR ANSWERS

13

A racing car, travelling with constant acceleration along a straight horizontal track, passes two points A and B which are 250 m apart. The car is timed from the point at which it is 50 m from A. It takes 4 s to reach A and then a further 8 s to reach B.

Calculate:
(a) the car's initial speed and its acceleration
(b) the car's speed when it is half way between A and B

TAP FOR ANSWERS

14

A game uses an unbiased die with faces numbered 1 to 6. The die is thrown once. If it shows 4, 5 or 6 then this number is the final score. If it shows 1, 2 or 3 it is thrown again and the final score is the sum of the numbers shown on the two throws.

(a) Find the probability that the final score is 4

(b) Given that the die is only thrown once, find the probability that the final score is 4

(c) Given that the die is thrown twice, find the probability that the final score is 4

TAP FOR ANSWERS

15

These are all places in the UK from the large data set.

i) Name the towns at A, B, C, D and E

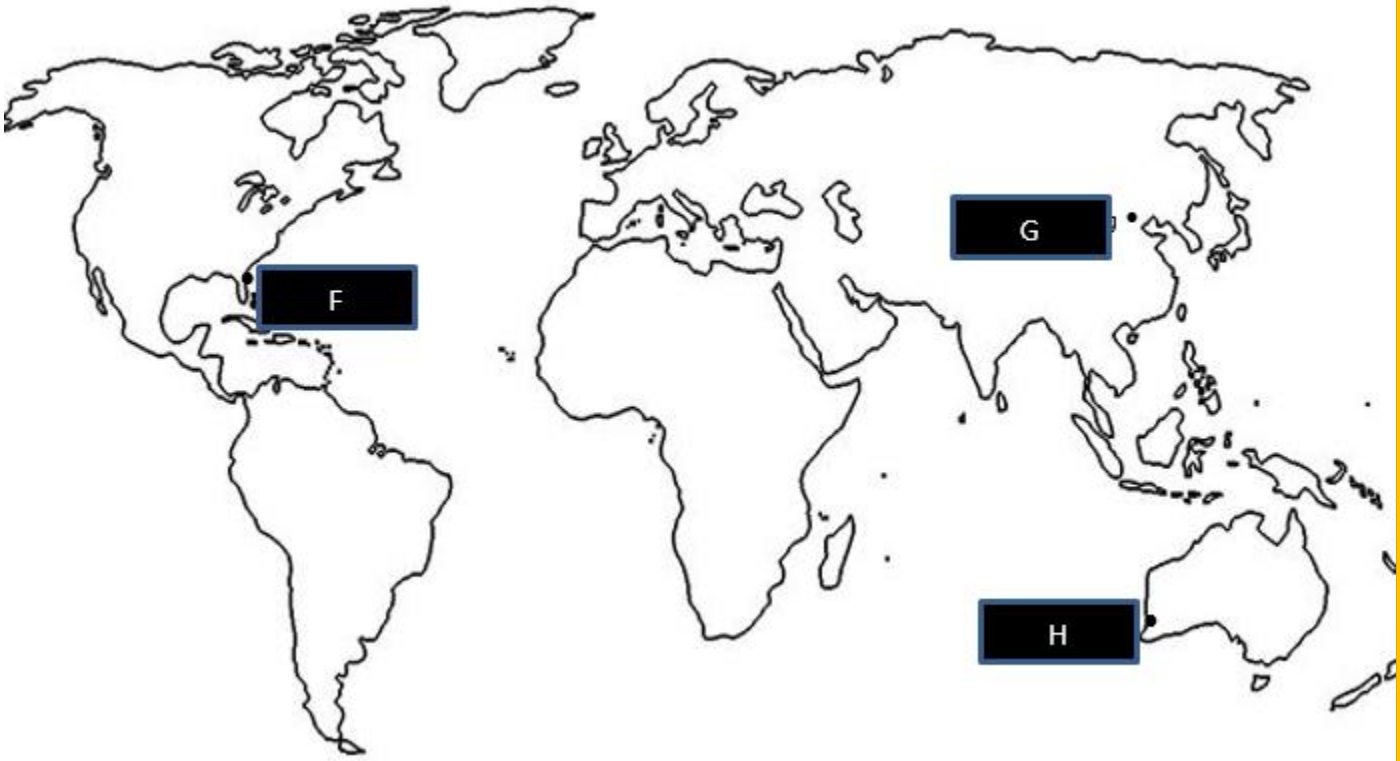
TAP FOR ANSWERS

15

These are also places from the large data set.

ii) a) Name the cities at F, G, and H

b) In which countries are cities F, G, and H ?



TAP FOR ANSWERS

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1 - Answers

Checked by your teacher

TAP TO RETURN

2 – Answers

(a) 12.8 cm
(b) 50.6 cm^2

TAP TO RETURN

3 - Answers

(a) $\frac{81}{256}$ (b) $\frac{81}{1024}$ (c) $\frac{3}{4}$ (d) $\frac{3}{32}$

TAP TO RETURN

4 - Answers

(a) 0.65

(b) 0.22

(c) 0.45

TAP TO RETURN

5 - Answers

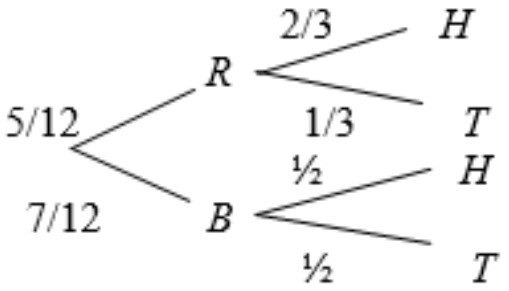
b) $218m^2$

c) An extra 17 seats

TAP TO RETURN

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 4B

6 - Answers



(b) $\frac{41}{72}$ (c) $\frac{20}{41}$ (d) $\frac{37}{72}$

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BHASVIC MαTHS
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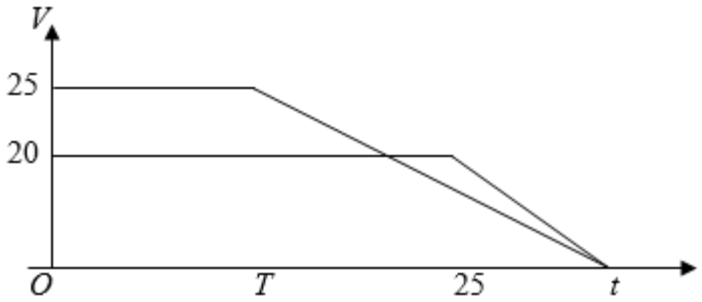
7 - Answers



$T=9$

TAP TO RETURN

8 - Answers

9.13 m s^{-1}

TAP TO RETURN

9 - Answers

(a) 54m

(b) 43m

TAP TO RETURN

10 - Answers

45 seconds

TAP TO RETURN

11 - Answers

(a) $\overline{x} = -\frac{33}{20}$ and $\sigma x = 1.97$ to $3.s.f$

(b) 8.24

TAP TO RETURN

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 4B

12 - Answers

A & C

B & C

TAP TO RETURN

13 - Answers

(a) 6.25 ms^{-1} 3.125 ms^{-2}

(b) 33.7 ms^{-1}

TAP TO RETURN

14 - Answers

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{6}$

TAP TO RETURN

15 - Answers

Look in the Large Data Set!

TAP TO RETURN