

BHASVIC MαTHS

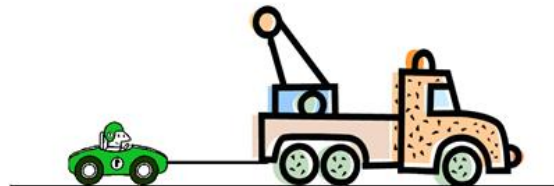
A1 DOUBLES ASSIGNMENT 10B

1

A truck of mass 800 kg is towing a car of mass 500 kg. The engine of the truck is exerting a pulling force of magnitude P N. The total resistance on the truck is 1200 N, and on the car 750 N. Find the acceleration of the system and the tension in the tow rope when P is;

- (a) 2000 N
- (b) 5000 N
- (c) 8000 N

Hint: Draw a diagram and consider the truck and car separately.



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A1 DOUBLES ASSIGNMENT 10B

2

[In this question, the unit vectors \mathbf{i} and \mathbf{j} are horizontal vectors due east and north respectively.]

At time $t = 0$, a football player kicks a ball from the point A with position vector $(2\mathbf{i} + \mathbf{j})$ m on a horizontal football field. The motion of the ball is modelled as that of a particle moving horizontally with constant velocity $(5\mathbf{i} + 8\mathbf{j})$ m s⁻¹. Find

- (a) the speed of the ball,
- (b) the position vector of the ball after t seconds.

The point B on the field has position vector $(10\mathbf{i} + 7\mathbf{j})$ m.

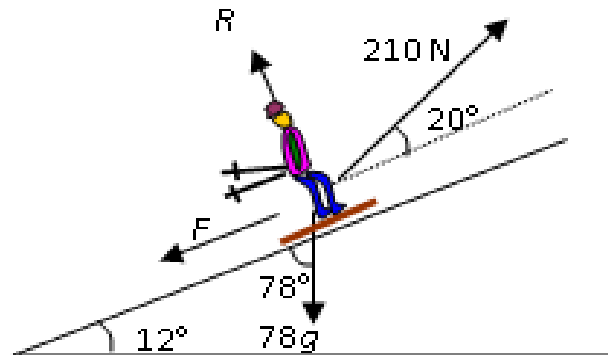
- (c) Find the time when the ball is due east of B .
- (d) Find the time when the ball is due north of B .

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A1 DOUBLES ASSIGNMENT 10B

3



A skier of mass 78 kg is pulled at constant speed up a rough slope of inclination 12° , by a force of magnitude 210 N acting upwards at an angle of 20° to the slope. Find the magnitudes of the frictional force and the normal contact force acting on the skier. to 3 significant figures.

Why is the normal contact force so much larger than friction? Give a reason.

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A1 DOUBLES ASSIGNMENT 10B

4

Jake and Kamil are sometimes late for school.
The events J and K are defined as follows

J = the event that Jake is late for school,
 K = the event that Kamil is late for school.

$P(J) = 0.25$, $P(J \cap K) = 0.15$ and $P(J' \cap K') = 0.7$.

On a randomly selected day, find the probability that

- (a) at least one of Jake or Kamil are late for school,
- (b) Kamil is late for school.

Given that Jake is late for school,

- (c) find the probability that Kamil is late.

The teacher suspects that Jake being late for school and Kamil being late for school are linked in some way.

- (d) Determine whether or not J and K are statistically independent.
- (e) Comment on the teacher's suspicion in the light of your calculation in part (d).

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A1 DOUBLES ASSIGNMENT 10B

5

A ship S is moving along a straight line with constant velocity. At time t hours the position vector of S is \mathbf{s} km. When $t = 0$, $\mathbf{s} = 9\mathbf{i} - 6\mathbf{j}$. When $t = 4$, $\mathbf{s} = 21\mathbf{i} + 10\mathbf{j}$. Find

- (a) the speed of S ,
- (b) the direction in which S is moving, giving your answer as a bearing.
- (c) Show that at time x $\mathbf{s} = (3t + 9)\mathbf{i} + (4t - 6)\mathbf{j}$.

A lighthouse L is located at the point with position vector $(18\mathbf{i} + 6\mathbf{j})$ km. When $t = T$, the ship S is 10 km from L .

- (d) Find the possible values of T .

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6

Four points have coordinates A (7, 12 -1), B (11, 2, -9), C (14, -14, 3) and D (8, 1, 15) respectively.

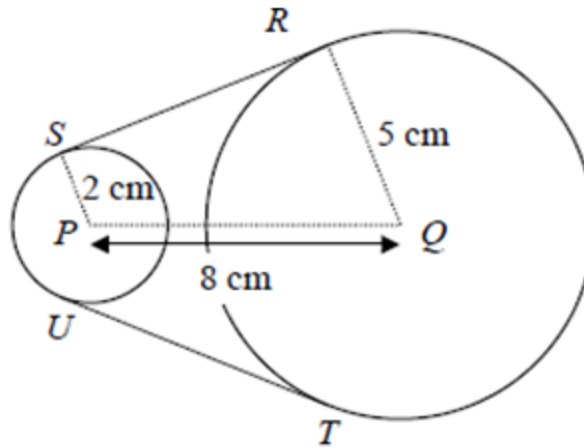
- (a) Show that AB and CD are parallel, and find the ratio $AB:CD$ in its simplest form.
- (b) Hence describe the quadrilateral $ABCD$.

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A1 DOUBLES ASSIGNMENT 10B

7



The gears in a toy are shown in the diagram above.

A thin rubber band passes around two circular discs. The centres of the discs are at P and Q where $PQ = 8\text{ cm}$ and their radii are 2 cm and 5 cm respectively. The sections of the rubber band not in contact with the discs, RS and TU , are assumed to be taut.

- Show that $\angle PQR = 1.186$ radians to 3 decimal places.
- Find the length RS
- Find the length of the rubber band in this situation.

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A1 DOUBLES ASSIGNMENT 10B

8

A ball is thrown from a window above a horizontal lawn. The velocity of projection is 15 m s^{-1} and the angle of elevation is α , where $\tan \alpha = \frac{4}{3}$. The ball takes 4 s to reach the lawn. Find

- (a) the horizontal distance between the point of projection and the point where the ball hits the lawn,
- (b) the vertical height above the lawn from which the ball was thrown.

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A1 DOUBLES ASSIGNMENT 10B

9

The histogram in Figure 1 shows the time taken, to the nearest minute, for 140 runners to complete a fun run.

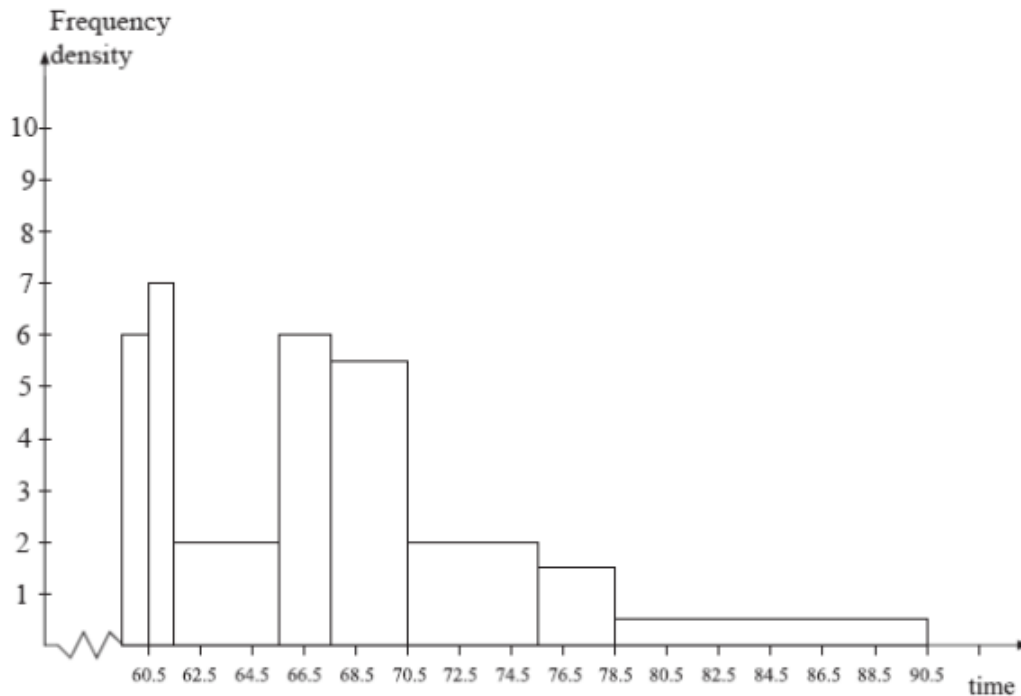


Figure 1

Use the histogram to calculate the number of runners who took between 78.5 and 90.5 minutes to complete the fun run.

In this question, if the height of the bar lies between 2 integer values, please use the lower value + 0.5

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(a) State in words the relationship between two events R and S when $P(R \cap S) = 0$.

The events A and B are independent with $P(A) = \frac{1}{4}$ and $P(A \cup B) = \frac{2}{3}$.

Find

(b) $P(B)$,

(c) $P(A' \cap B)$,

(d) $P(B' | A)$.

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A1 DOUBLES ASSIGNMENT 10B

11

The point P lies on the curve with equation

$$y = 4e^{2x+1}.$$

The y -coordinate of P is 8.

- (a) Find, in terms of $\ln 2$, the x -coordinate of P .
- (b) Find the equation of the tangent to the curve at the point P in the form $y = ax + b$, where a and b are exact constants to be found.

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A1 DOUBLES ASSIGNMENT 10B

12

A rule for multiplying by 11 in your head is shown.

$$\begin{array}{r} (3\ 4\ 5) \times 11 \\ \downarrow \quad \downarrow \quad \downarrow \\ 3\ 7\ 9\ 5 \end{array}$$

Working from the right:

- 1** Write down the 5
- 2** Add $5 + 4$, add $4 + 3$
- 3** Write down the 3

Prove algebraically that this rule works but state a 'catch.'

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BHAVIC MATHS

A1 DOUBLES ASSIGNMENT 10B

13

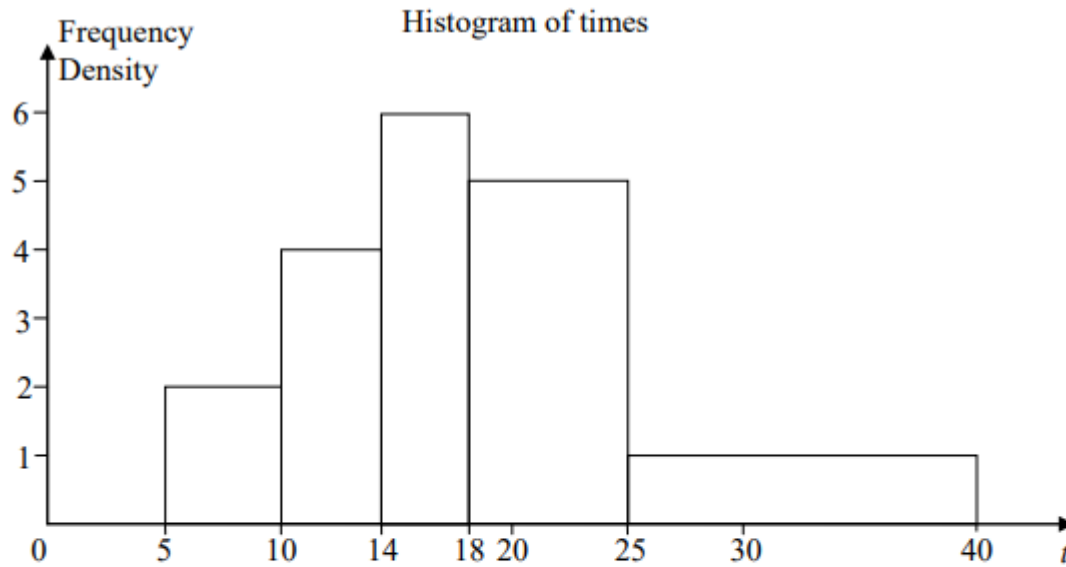


Figure 2

Figure 2 shows a histogram for the variable t which represents the time taken, in minutes, by a group of people to swim 500 m.

(a) Copy and complete the frequency table for t .

t	5 – 10	10 – 14	14 – 18	18 – 25	25 – 40
Frequency	10	16	24		

PTO

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 10B

13 continued

- (b) Estimate the number of people who took longer than 20 minutes to swim 500 m.
- (c) Find an estimate of the mean time taken.
- (d) Find an estimate for the standard deviation of t .
- (e) Find the median and quartiles for t .

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BHASVIC MATHS

A1 DOUBLES ASSIGNMENT 10B

14

Fig. 8 shows the graph of $\log_{10} y$ against $\log_{10} x$. It is a straight line passing through the points $(2, 8)$ and $(0, 2)$.

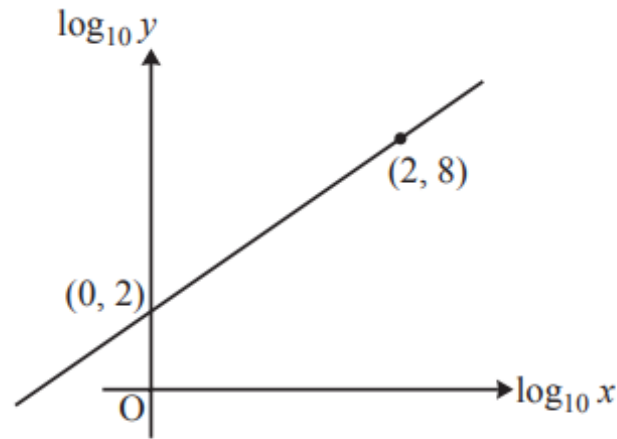


Fig. 8

Find the equation relating $\log_{10} y$ and $\log_{10} x$ and hence find the equation relating y and x .

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A1 DOUBLES ASSIGNMENT 10B

15

Joshua compares the amount of rain in 2015 between Heathrow and the city X on the continent of Asia using the Large Data Set.

(a) Write down the name of the city X that Joshua compares with Heathrow.

At random, he selects 8 data points about the daily total rainfall, in mm, in May 2015 for the two cities. These 8 data points are shown below.

Heathrow:	7.0	0.2	1.2	tr	0.8	6.8	0.2	4.2
City X:	6.0	0.0	20.7	9.0	14.3	0.5	0.0	0.4

(b) Explain what is meant by the reading 'tr'.

(c) State one

(i) advantage

(ii) disadvantage

of Joshua using 8 data points from the large data set for his comparisons.

PTO

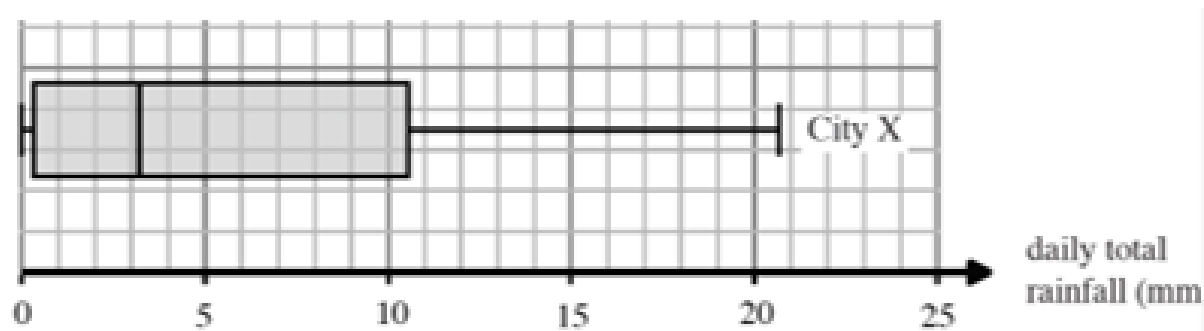
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A1 DOUBLES ASSIGNMENT 10B

15

The diagram below shows a box-plot for the data collected by Joshua on the rainfall in the city X in May 2015.



Draw another box-plot to represent the data collected by Joshua for Heathrow. In your data processing, take 'tr' to mean 0.0 mm of rainfall and ignore outliers.

(e) Compare the amount of rainfall in May 2015 between Heathrow and the city X.

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A1 DOUBLES ASSIGNMENT 10B

1 - Answers

(a) 0.038 ms^{-2} , 769N

(b) 2.35 ms^{-2} , 1925N

(c) 4.65 ms^{-2} , 3075N

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

2 - Answers

- (a) 9.43 m s^{-1}
- (b) $(2+5t)\mathbf{i} + (1+8t)\mathbf{j}$
- (c) 1.6 s
- (d) 0.755s

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

3 - Answers

F=38.4N, R=676N

TAP TO RETURN

BHASVIC MαTHS

A1 DOUBLES ASSIGNMENT 10B

4 - Answers

- (a) $P(J \cup K) = 0.3$
- (b) $P(K) = 0.2$
- (c) $P(K | J) = 0.6$
- (d) Not statistically independent (need to show how)
- (e) Confirms teacher's suspicion

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

5 - Answers

(a) 5 km h⁻¹

(b) 36.9°

(d) 1, 5 hours

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

6 - Answers

(a)

$$\overrightarrow{AB} = 4\mathbf{i} - 10\mathbf{j} - 8\mathbf{k} = 2(2\mathbf{i} - 5\mathbf{j} - 4\mathbf{k})$$

$$\overrightarrow{CD} = 6\mathbf{i} + 15\mathbf{j} + 12\mathbf{k} = -3(2\mathbf{i} - 5\mathbf{j} - 4\mathbf{k})$$

$$\overrightarrow{CD} = -\frac{3}{2}\overrightarrow{AB}, \text{ so } AB \text{ is parallel to } CD$$

$$AB:CD = 2 : 3$$

(b) $ABCD$ is a trapezium

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

7 - Answers

(a) 1.186

(b) 7.42 cm

(c) 39.1 cm

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

8 - Answers

(a) 36 m

(b) 30 m (2 s.f.)

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

9 - Answers

Number of runners is 12

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

10 - Answers

a) R and S are mutually exclusive

b) $P(B) = \frac{5}{9}$

c) $P(A' \cap B) = \frac{5}{12}$

d) $P(B' | A) = \frac{4}{9}$

TAP TO RETURN

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A1 DOUBLES ASSIGNMENT 10B

11 - Answers

a) $x = \frac{1}{2}(\ln 2 - 1)$

b) $y = 16x + 16 - 8 \ln 2$

TAP TO RETURN

BHAVIC MATHS
A1 DOUBLES ASSIGNMENT 10B

12 - Answers

Proof

TAP TO RETURN

BHASVIC MαTHS

A1 DOUBLES ASSIGNMENT 10B

13 - Answers

- a) 18-25 group, area= $7 \times 5 = 35$
25-40 group, area= $15 \times 1 = 15$
- b) 40
- c) 18.91
- d) 7.26
- e) Median = 18 LQ= 13.75 UQ= 23

TAP TO RETURN

BHAVIC MATHS
A1 DOUBLES ASSIGNMENT 10B

14– Answers

$$m = 3$$

$$y = 100x^3$$

TAP TO RETURN

BHASVIC MαTHS

A1 DOUBLES ASSIGNMENT 10B

15 answers

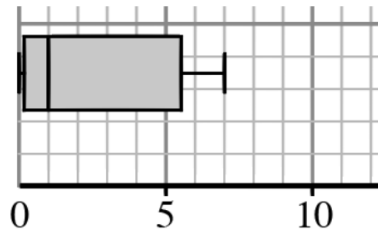
. a) Beijing

b) tr means a rainfall of less than 0.05 mm

c) i) large data set has many more than 8 data points, so using 8 points is easier to process, it is quicker to process and requires less analysis

ii) large data set has many more than 8 data points, so using 8 points may not very representative and may lead to inaccurate and unreliable conclusions

d)



e) Heathrow had less rainfall on average than City X as the median is lower; Heathrow had less variation in the amount of rainfall it received than City X, as the Interquartile range and the range is smaller

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