BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

1

A person throws a ball in a sports hall. The height of the ball, h m, can be modelled in relation to the horizontal distance from the point it was thrown from by the quadratic equation: $h = -\frac{3}{10}x^2 + \frac{5}{2}x + \frac{3}{2}$

The hall has a sloping ceiling which can be modelled with equation $h = \frac{15}{2} - \frac{1}{5}x$.

Determine whether the model predicts that the ball will hit the ceiling.

TAP FOR ANSWERS

2

A geologist is looking for fossils in rocks. In a certain area it has been established over a long period of time that 10% of the rocks contain fossils. The geologist selects twenty rocks from this area.

a) State two conditions that must apply for a binomial model to be valid

Find the probability that in the geologists sample there will be

b) One rock containing fossils

c) At least one rock containing fossils

The geologists selects a new sample of n rocks

She wants to have at least 95% chance that her new sample will contain fossils

d) Determine the smallest value of n

TAP FOR ANSWERS

3

A car accelerates at a constant rate, starting from rest at a point A and reaching a speed of 65 km s^{-1} 26 s. This speed is then maintained and the car passes a point B 3 minutes after leaving A.

(a) Sketch a speed-time graph to illustrate the motion of the car.

(b) Find the distance from A to B.

TAP FOR ANSWERS

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4

Draw a force diagram and resolve forces horizontally and vertically. N.B. In the case o limiting friction, $F = \mu R$, where R is the normal reaction.

An airline passenger pushes a 15kg suitcase along the floor with his foot. A force (P) of 60N is needed to move the suitcase. Find:-

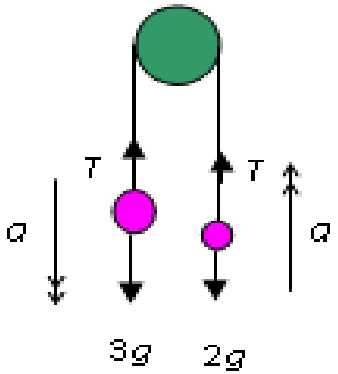
(a) the co-efficient of friction.

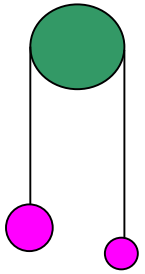
(b) the force needed to give the suitcase an acceleration of $0.2ms^{-2}$.

TAP FOR ANSWERS

5

Two masses of 3kg and 2kg are suspended either end of a light inextensible string which passes over a smooth fixed peg. The particles are held in the positions shown, with the string taut; they are then released from rest. Construct separate equations for each of the masses. Find the tension in the string and the acceleration of the particles.





TAP FOR ANSWERS

6

[In this question, the horizontal unit vectors **i** and **j** are directed due East and North respectively.]

A coastguard station *O* monitors the movements of ships in a channel. At noon, the station's radar records two ships moving with constant speed. Ship *A* is at the point with position vector $(-5\mathbf{i} + 10\mathbf{j})$ km relative to *O* and has velocity $(2\mathbf{i} + 2\mathbf{j})$ km h^{-1}. Ship *B* is at the point with position vector $(3\mathbf{i} + 4\mathbf{j})$ km and has velocity $(-2\mathbf{i} + 5\mathbf{j})$ km h^{-1}.

(a) Given that the two ships maintain these velocities, show that they collide.
The coast guard radios ship *A* and orders it to reduce its speed to move with velocity $(\mathbf{i} + \mathbf{j})$ km h^{-1}.

Given that *A* obeys this order and maintains this new constant velocity,

(b) find an expression for the vector $\overrightarrow{AB}$ at time t hours after noon.
(c) find, to 3 significant figures, the distance between A and B at 1400 hours,
(d) find the time at which *B* will be due north of *A*.

TAP FOR ANSWERS

7

(a) By completing the square, find in terms of the constant *k* the roots of the equation $x^2 + 4kx - k = 0$

(b) Hence or otherwise find the set of values of *k* for which the equation has

(i) no real roots

(ii) one repeated root

(iii) real roots

TAP FOR ANSWERS

8

(a) Find the equation of the circle where the points (1, 0) and (3, 0) are at either end of the diameter.

(b) The circle has a tangent at point *A* that also passes through the point *B* (6, 0). Find the distance *AB*.

TAP FOR ANSWERS

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9

The temperature, T °C, of a cup of tea is given by $T = 55e^{-\frac{t}{8}} + 20 \qquad t \geq 0$, where t is the time in minutes since measurements began.

a) Briefly explain why $t \geq 0$

b) State the starting temperature of the cup of tea.

c) Find the time at which the temperature of the tea is 50 °C, giving your answer to the nearest minute.

d) By sketching the graph or otherwise, explain why the temperature of the tea will never fall below 20 °C

TAP FOR ANSWERS

10

The diameters of 100 pebbles were measured. The measurements rounded to the nearest millimetre, x, are summarised in the table.

x	$10 \leqslant x \leqslant 19$	$20 \leqslant x \leqslant 24$	$25 \leqslant x \leqslant 29$	$30 \leqslant x \leqslant 49$
Number of stones	25	22	29	24

These data are to be presented on a statistical diagram.

(a) For a histogram, find the frequency density of the $10 \leq x \leq 19$ class.

(b) For a cumulative frequency graph, state the coordinates of the first two points that should be plotted.

(c) Why is it not possible to draw an exact box-and-whisker plot to illustrate the data?

TAP FOR ANSWERS

11

(a) A bag contains 12 red discs and 10 black discs. Two discs are removed at random, without replacement. Find the probability that both discs are red.

(b) Another bag contains 7 green discs and 8 blue discs. Three discs are removed at random, without replacement. Find the probability that exactly two of these discs are green.

TAP FOR ANSWERS

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12

Use your calculators to work out the following

(a) For $X \sim B(6, {}^{1}/_{3})$

(i) $P(X=4)$ (ii) $P(X \leq 2)$

(b) For $X \sim B(8, 0.4)$

(i) $P(X=2)$ (ii) $P(X=0)$ (ii) $P(X>6)$

(c) For $X \sim B(10, 0.45)$ find:

(i) $P(X = 6)$ (ii) $P(X \leq 3)$

TAP FOR ANSWERS

Find the following values of x for the various distributions

(a) $X \sim B(20,0.2)$
$P(X \leq x) \leq 0.05$
$P(X \geq x) \geq 0.05$

(b) $X \sim B(10,0.3)$
$P(X \leq x) \leq 0.025$
$P(X \geq x) \geq 0.025$

(c) $X \sim B(15,0.35)$
$P(X \leq x) \leq 0.01$
$P(X \geq x) \geq 0.01$

TAP FOR ANSWERS

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14

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

TAP FOR ANSWERS

BHASVIC MαTHS
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15

Complete this old spec C2 paper
https://www.madasmaths.com/archive/iygb_practice_papers/c2_practice_papers/c2_n.pdf

TAP FOR ANSWERS

1 - Answers

Yes, the ball will hit the ceiling.

TAP TO RETURN

2 - Answers

b) 0.2702, c) 0.8787, d)n=29

TAP TO RETURN

3 - Answers

(b) 10855 km

TAP TO RETURN

4 - Answers

(a) $\mu=0.408$

(b) $P=63N$

TAP TO RETURN

5 - Answers

(a) $1.96\ ms^{-2}$

(b) T=23.5N

TAP TO RETURN

6 - Answers

(b) $AB = (8 - 3t)\mathbf{i} + (-6 + 4t)\mathbf{j}$

(c) 2.83 km

(d) 1440 hours

TAP TO RETURN

7 - Answers

(a) $x = -2k \pm \sqrt{4k^2 + k}$

(b)

(i) $-\frac{1}{4} < k < 0$ (you must include a sketch)

(ii) $k = -\frac{1}{4}, 0$

(iii) $k \leq -\frac{1}{4}$ *or* $k \geq 0$ (you must include a sketch)

TAP TO RETURN

8 - Answers

(a) $(x-2)^2 + y^2 = 1$

(b) $\sqrt{15}$

TAP TO RETURN

9 - Answers

a) We cannot go backwards in time
b) 75 °C
c) 5 minutes
d) The exponential term will always be positive
so the overall temperature will be greater than
20 °C

TAP TO RETURN

10 - Answers

(a) 2.5

(b) (0, 0), (19.5, 25)

11 - Answers

(a) $\frac{2}{7}$

(b) $\frac{24}{65}$

TAP TO RETURN

12 - Answers

(a) 0.0823 0.6804

(b) 0.209 0.0168 0.0085

(c) 0.1596 0.2660

TAP TO RETURN

13 - Answers

(a) 0, 7

(b) N/A, 6

(c) 0, 10

TAP TO RETURN

14 - Answers

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

TAP TO RETURN

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15 - Answers

https://www.madasmaths.com/archive/iygb_practice_papers/c2_practice_papers/c2_n_marks.pdf

TAP TO RETURN