BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 7B

1

Joel buys a box of second-hand Jazz and Blues CDs at a car boot sale. In the box there are 30 CDs, 8 of which were recorded live. 16 of the CDs are predominantly Jazz and 13 of these were recorded in the studio. This information is shown in the following table.

	Studio	Live	Total
Jazz	13		16
Blues			
Total		8	30

(a) Copy and complete the table above.

Joel picks a CD at random to play first.

Find the probability that it is

(b) a Blues CD that was recorded live,

(c) a Jazz CD, given that it was recorded in the studio.

TAP FOR ANSWERS

2

A particle of mass 2 kg lies on a rough plane. The plane is inclined to the horizontal at 30°.
The coefficient of friction between the particle and the plane is 0.25. The particle is held in equilibrium by a force of magnitude P newtons. The force makes an angle of 20° with the horizontal and acts in a vertical plane containing a line of greatest slope of the plane, as shown in Figure 1. Find the least possible value of P.

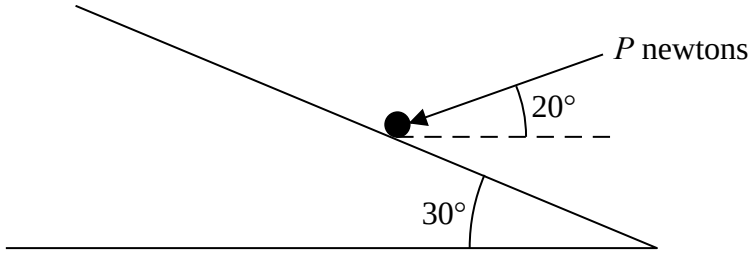

Figure 1

TAP FOR ANSWERS

3

Solve the following:

(a) $\log_6 4 + \log_6 x = 2$

(b) $\log_4(x+1) - \log_4 3 = 1$

(c) $\log_3(x+1) - 2\log_3 x = 2$

TAP FOR ANSWERS

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Remember, *vertically you can use y, or* $s_y = u_y t + \frac{1}{2}at^2$, *horizontally x or* $s_x = u_x t$. *For the Cartesian equation of the flight path, you need to eliminate t between these equations.*

An arrow is fired from a bow with a speed of 50 ms $^{-1}$ at an angle of 5^o above the horizontal.

(a) Calculate the height of the arrow after 0.6 s.
(b) What is its speed after 6 s?
(c) Find the acute angle that the arrow makes with the horizontal after 6 s?
(d) Show that the equation of the flight of the arrow is

$$y = (tan5)x - (\frac{4.9}{(50cos5)^2})x^2$$

TAP FOR ANSWERS

5

The triangle with vertices (0, 0), (1, p), (10, 0) is right angled. Find the two possible values of p.

TAP FOR ANSWERS

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Particles *A* and *B* each of mass *20kg* are joined by a light inextensible string which passes over a smooth pulley so that the string hangs vertically on both sides. The system is in **equilibrium**.

a) Draw a force diagram to model this situation.

b) By considering each particle separately, find the tension T in the string.

c) How have you used the fact that the string is light in your model?

d) How have you used the fact that the string is inextensible in your model?

e) How have you used the fact that the pulley is smooth in your model?

TAP FOR ANSWERS

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A particle moves along a straight line. It accelerates from rest to a speed of 12 ms^{-1}. It then moves at a constant speed of 12 ms^{-1} for a period of time. Then the particle decelerates uniformly in twice the time for which it was accelerating, coming to rest after a total time of 19 seconds. Given that the total distance travelled by the particle is 174 m,

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

(b) find the time for which the particle is travelling at constant speed.

(c) find the time for which to particle is accelerating, and the acceleration of the particle.

TAP FOR ANSWERS

8

A woman of mass 60kg is in a lift.
(a) Draw a diagram showing the forces acting on the woman when the lift is stationary

Find the normal reaction of the floor of the lift on the woman in each of the following cases:
(b) The lift is moving upwards at a constant speed of 3 ms^{-1}

(c) The lift is moving upwards with an acceleration of 2 ms^{-2} upwards

(d) The lift is moving downwards at an acceleration of 2 ms^{-2} downwards

(e) The lift is moving downwards and slowing down with a deceleration of 2ms^{-2}

In order to calculate the maximum number of people that can be safely carried in the lift, the following assumptions are made: the lift has mass 300kg, all resistances to motion may be considered negligible and ignored, the mass of each occupant is 75kg and the tension in the supporting cable should not exceed 12,000N.

(f) What is the maximum number of people who can be safely carried if the magnitude of the acceleration does not exceed 3 ms^{-2}.

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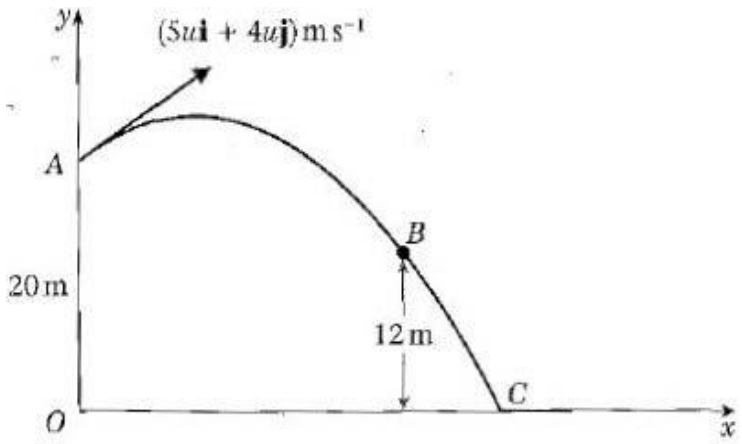
[In this question, the unit vectors **i** and **j** *are in a vertical plane,* **i** *being horizontal and* **j** *being vertical]*

A particle P is projected from a point A with position vector 20 m with respect to a fixed origin O. The velocity of projection is $(5u\mathbf{i} + 4u\mathbf{j})\text{m s}^{-1}$. The particle moves freely under gravity, passing through a point B, which has position vector $(k\mathbf{i} + 12\mathbf{j})\text{m}$, where k is a constant, before reaching the point C on the x-axis, as shown in the figure below. The particle takes 4 s to move from A to B. Find

a) the value of u,

b) the value of k,

c) the angle the velocity of P makes with the x-axis as it reaches C.



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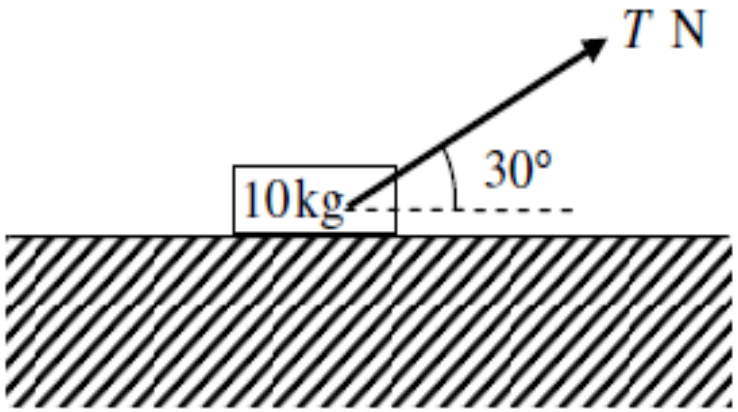

The figure above shows a small box of mass of 10kg, pulled by a rope inclined at 30^o to the horizontal, along rough horizontal ground
The tension in the rope is T N and the particle is accelerating at $0.4\ ms^{-2}$. The box is modelled as a particle experiencing a frictional force of $12N$ and a formal reaction of R N.

Determine the value of T and the value of R.

TAP FOR ANSWERS

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A particle P is projected from a point O on level ground with speed 50 ms^{-1} at an angle Θ where
$\sin\Theta = \left(\frac{7}{25}\right)$ above the horizontal. Find:

(a) the height of P at the point where its horizontal displacement from 0 is 120 m,
(b) the speed of P two seconds after projection,
(c) the times after projection at which P is moving at an angle of $\tan^{-1}\left(\frac{1}{6}\right)$ to the ground

TAP FOR ANSWERS

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A bag contains 64 coloured beads. There are r red beads, y yellow beads and 1 green bead
and $r + y + 1 = 64$

Two beads are selected at random, one at a time without replacement.

(*a*)Find the probability that the green bead is one of the beads selected.

The probability that both of the beads are red is $\frac{5}{84}$

(b) Show that r satisfies the equation $r^2 - r - 240 = 0$

(c) Hence show that the only possible value of r is 16

(*d*)Given that at least one of the beads is red, find the probability that they are both red.

TAP FOR ANSWERS

13

Draw a labelled diagram, form labelled equations and re-arrange the equations to find the unknowns.

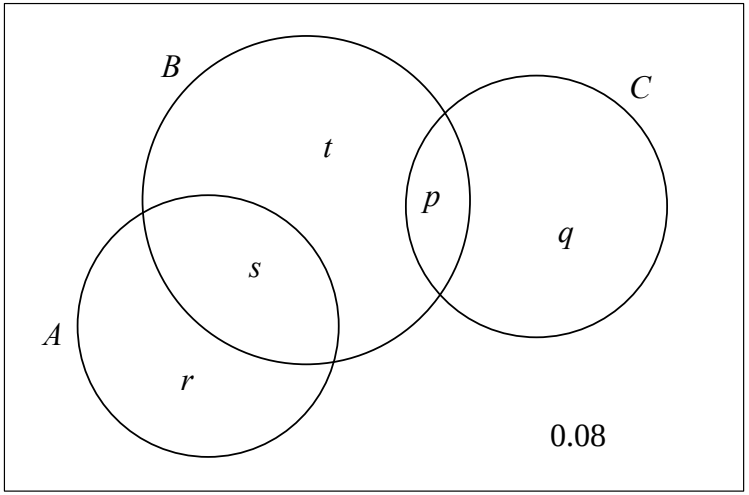
A stone that is modelled as a particle of mass m kg sits on a smooth slope of angle 60^o to the horizontal, it is held at rest by a light inextensible string parallel to the slope that is fixed at point A at the top of the slope. The tension in the string is 8N. Find the mass of the particle and the size of the reaction force between the particle and the slope force, giving your answers to 3sf.

A brick that is modelled as a particle of mass 5 kg sits on a smooth slope of angle α to the horizontal, it is held at rest by a light inextensible string parallel to the slope that is fixed at point A at the top of the slope. Given that the reaction force between the slope and the particle is 21N. Find the angle α, and the tension in the string.

TAP FOR ANSWERS

13

The Venn diagram shows three events A, B and C, where p, q, r, s and t are probabilities.



P(A) = 0.5, P(B) = 0.6 and P(C) = 0.25 and the events B and C are independent.

(a) Find the value of p and the value of q.

(b) Find the value of r.

(c) Hence write down the value of s and the value of t.

(d) State, giving a reason, whether or not the events A and B are independent.

(e) Find P($B \mid A \cup C$).

TAP FOR ANSWERS

14

(i) Find the value of y for which

$1.01^{y-1} = 500$

Give your answer to 2 decimal places.

(ii) Given that

$2\log_4(3x + 5) = \log_4(3x + 8) + 1, \qquad x > -\frac{5}{3}$

(*a*) show that

$9x^2 + 18x - 7 = 0$

(*b*) Hence solve the equation

$2\log_4(3x + 5) = \log_4(3x + 8) + 1, \qquad x > -\frac{5}{3}$

TAP FOR ANSWERS

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15

1. Diane kept a diary during her stay in Cornwall in the Summer of 2015. These are extracts from her diary on the first day of every month between May and October. Use the large data set to find the month of each entry

A: After such a sunny day yesterday, it was disappointing that I only saw the sun briefly today.
B: It was the fourth dry day in a row. Beautiful sunny day although a bit on the cold side.
C: I was looking forward to today because I fancied going on a cliff top walk to look at the views. The weather let me down. It was cloudy all day and fairly windy.
D: It was a warm humid day.
E: Woke up late. It was pouring with rain outside and it was cold and windy.
F: Sunshine and showers today. I went for a walk on the cliff tops and the views were amazing. I could see for miles, or so it seemed.

PTO

TAP FOR ANSWERS

15 continued

2. What is humidity?

3. Investigate the correlation between humidity and cloud cover.

4. Investigate the correlation between humidity and temperature

TAP FOR ANSWERS

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1 - Answers

(a)

	Studio	Live	Total
Jazz	13	3	16
Blues	9	5	14
Total	22	8	30

(b) $\frac{1}{6}$

(c) $\frac{13}{22}$

TAP TO RETURN

2 – Answers

P= 6.7

TAP TO RETURN

3 - Answers

(a) 9

(b) 11

(c) 0.393

TAP TO RETURN

4 - Answers

(a) 0.85m
(b) 74 ms^{-1}
(c) 47.5^{o}

TAP TO RETURN

5 - Answers

$p = \pm 3$

TAP TO RETURN

6 - Answers

(a) Diagram checked by your teacher.
(b) T = 20g N
(c) “tension at A is the same magnitude as tension at B”
(d) “acceleration of A is same magnitude as acceleration of B” (in this case there’s no acceleration as it’s in equilibrium)
(e) “tensions in two parts of the string are the same” (if there was friction in the pulley it makes sense that this would NOT be true, right?)

TAP TO RETURN

7 - Answers

(b) 10 seconds

(c) 3 seconds, $a = 4\text{ms}^{-2}$

TAP TO RETURN

8 - Answers

(b) 588N

(c) 708N

(d) 468N

(e) 708

(f) 8 people

TAP TO RETURN

9 - Answers

(a) $m = 0.943\text{kg}$ (3sf) $R = 4.62\text{N}$ (3sf)

(b) $\alpha = 64.6^{\circ}$ (3sf), $T = 44.3$ N (3sf)

TAP TO RETURN

10 - Answers

(a) 4.4

(b) 88

(c) 50° (2 s.f.)

TAP TO RETURN

11 - Answers

T = 18.5 N R=88.8 N

TAP TO RETURN

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11 - Answers

a) 4.4m

b) 48 ms^{-1}

c) 0.61s and 2.2s

TAP TO RETURN

12 - Answers

(a) $\frac{1}{32}$

(c) $r=16$

(d) $\frac{5}{37}$

TAP TO RETURN

13 - Answers

(a) 0.15
(b) 0.22
(c) 0.28
(d) Not independent
(e) $\frac{43}{75}$

TAP TO RETURN

14 - Answers

(i) 625.56

(iii) $\frac{1}{3}$

TAP TO RETURN

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15 - Answers

1)
A: August 1st
B: October 1st
C: May 1st
D: July 1st
E: June 1st
F: September 1st

2. **Humidity** is a term used to describe the amount of water vapour present in air.

TAP TO RETURN