Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						E	G	3	0	8	/	0	1	Signature

Paper Reference(s)

EG308/01

Edexcel

Principal Learning Engineering

Level 3

Unit 8: Mathematical Techniques and Applications for Engineers

Sample Assessment Material

Time: 1 hour 15 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

Materials required for examination
Ruler, pen, HB pencil, eraser, calculator

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
Do not use pencil. Use blue or black ink.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 6 questions in this question paper. The total mark for this paper is 60.
There are 16 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You are reminded of the importance of clear and careful presentation in your answers. You are advised to read the questions carefully.

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Leave blank

Answer ALL questions.

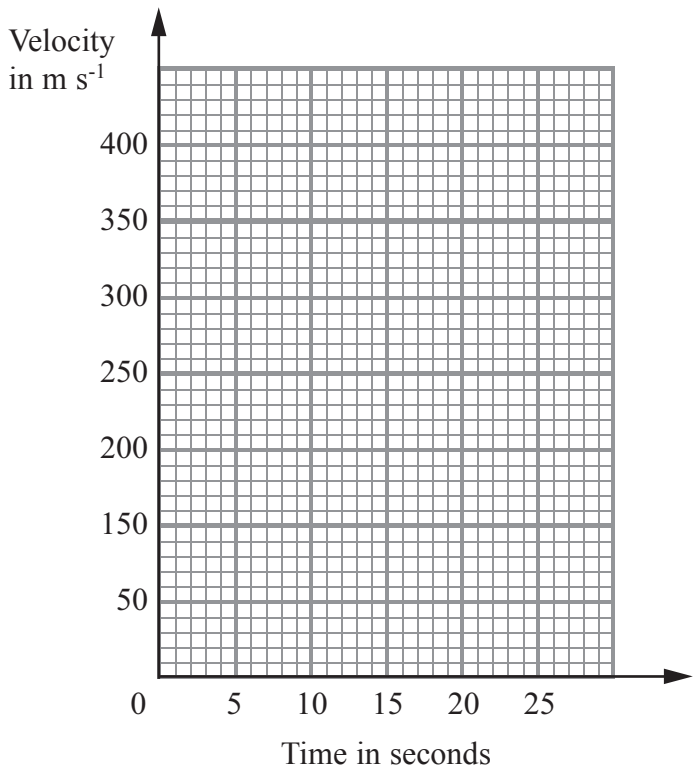
Write your answers in the spaces provided.

You must write down all stages in your working.

1. (a) The table below shows the velocity, v m s^{-1}, of a projectile at time t s after it was launched from an aircraft:

Time, t (seconds)	5	10	15	20	25
Velocity, v (m s^{-1})	115	175	235	295	355

(i) Assuming that the velocity is changing at a constant rate, plot a velocity-time graph for the projectile for the period $0 \leq t \leq 25$



(2)

Leave blank

(ii) Use your graph to determine a formula for v in terms of t.

v = ...

(2)

(b) The Work-Energy Principle can be written as:

$$W_T = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

Write down an expression for W_T in fully factorised form.

(2)

Leave blank

(c) The distance s m travelled by a car t seconds after passing a road sign is given by the formula $s = 27t + 3t^2$

Find how long it takes the car to travel a distance of 66 m past the road sign.

Time = ...s

(3)

Q1

(Total 9 marks)

Leave blank

2. (a) Show, using a sketch of a right angled triangle, that if $\sin\theta = \frac{8}{17}$, where θ is an acute angle, then $\cos\theta = \frac{8}{17}$.

(3)

(b) A voltage, v volts, in a circuit is given by the equation $v = 1 + \cos\theta$.

Sketch a graph of the voltage v over the range $\theta = 0°$ to $\theta = 360°$.

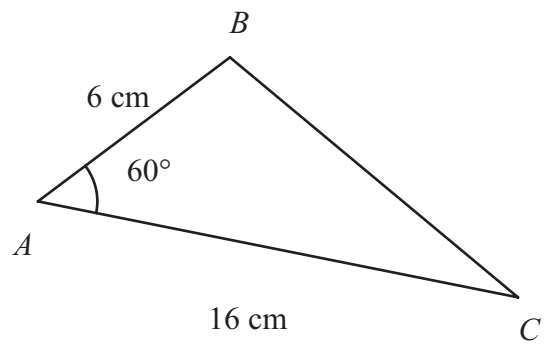
Use your graph to determine the value of voltage when $\theta = 270°$.

When $\theta = 270°$, $v =$ .....

(4)

Leave blank

(c) A triangular metal plate ABC has $AB = 6$ cm, $AC = 16$ cm and angle $BAC = 60°$. Find the length of BC.



$BC =$ .....

(3)

Q2

(Total 10 marks)

Leave blank

3. (a) A sealed cylindrical tank has diameter 0.5 m and height 1.5 m. Find the total external surface area of the tank.

Surface area = ... m^2

(3)

(b) Determine the length of an arc of a circular vehicle test track given that the track has a diameter of 1.5 km and the angle subtended by the arc at the centre of the track is 120°.

Length = ... km

(3)

Leave blank

(c) A flywheel revolves at 300 rpm. Express this in radians **per second**.

(3) **Q3**

(Total 9 marks)

Leave blank

4. The following data was obtained (to the nearest whole number) on a batch of 199 resistors with a marked value of 100 Ω:

Actual resistance value (Ω)	96	97	98	99	100	101	102	115
Frequency	1	1	3	20	56	61	37	20

(a) (i) Calculate, to the nearest whole number, the mean resistance value of the batch.

Mean = ... Ω
(4)

(ii) Calculate the median resistance value of the batch.

Median = ... Ω
(3)

Leave blank

(b) State, with a reason, which of these two averages you would use to summarise the data.

.....

.....

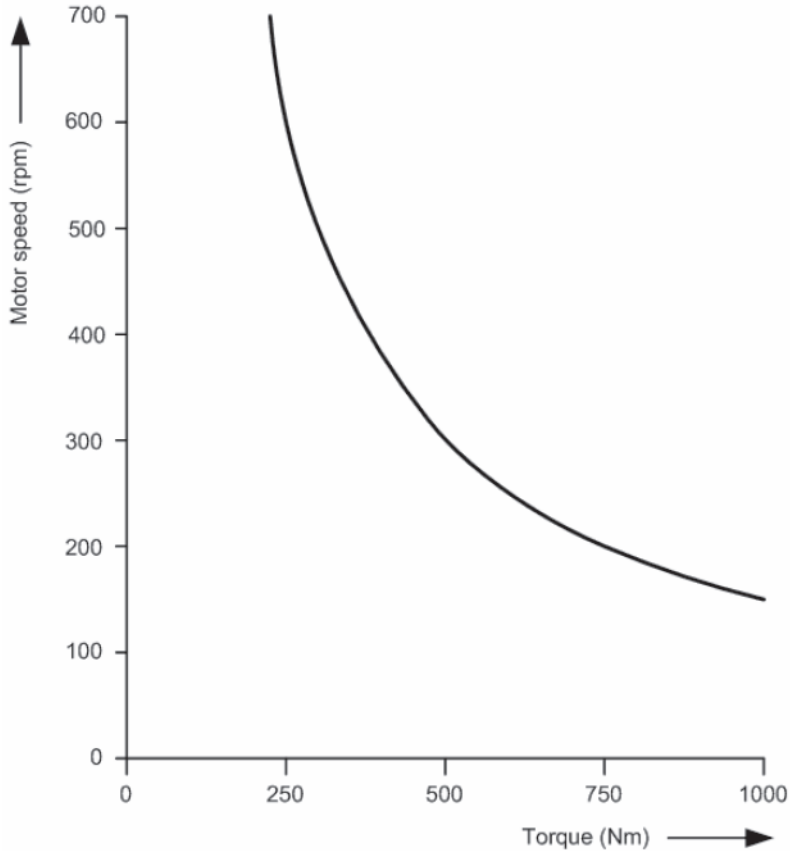
.....

(2) **Q4**

(Total 9 marks)

Leave blank

5.



(a) The graph above shows how the speed of a motor varies with torque.

Draw a tangent to the graph and use it to determine the rate of change of torque with speed when the torque is 500 Nm.

$\Delta T/\Delta s$ = ... Nm/rpm

(3)

Leave blank

(b) The velocity v of an aircraft at time t is given by the equation $v = 2t^2 + 5$

(i) Use calculus to derive an expression for the acceleration of the body at time t.

a = ...

(2)

(ii) Find the acceleration at $t = 2$ s.

a = ... m/s^2

(1)

(c) Use calculus to determine the distance travelled by the aircraft between $t = 0$ and $t = 4$ s.

Distance = ... m

(4)

Q5

(Total 10 marks)

Leave blank

6. (a) (i) Make l the subject of the formula $t = 2\pi\sqrt{\frac{l}{g}}$

l = ...

(3)

(ii) Find l when $t = 2$ s and $g = 9.81$ m/s^2.

l = ... m

(2)

Leave blank

(b) Given that $A = 20\log_{10}\left(\frac{V_{out}}{V_{in}}\right)$,

determine V_{out} when $V_{in} = 0.15$ and $A = 36$

V_{out} = ...

(4)

Leave blank

(c) The voltage developed across a capacitor is given by the relationship,

$$Vc = V\left(1 - e^{-\frac{1}{CR}}\right)$$

Determine the value of C when $V_c = 50$, $V = 100$, $R = 1 \times 10^6$, and $t = 200$

C = ...

(4) **Q6**

(Total 13 marks)

TOTAL FOR PAPER: 60 MARKS

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