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Mark Scheme

Principal Learning

Sample Assessment Material
EG308
Engineering
Level 3 Unit 8:
Mathematical Techniques and Applications for Engineers

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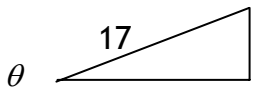
Question Number	Answer	Mark
1(a)(i)	Points correctly plotted [B1] Line drawn through points (ft from their points) [B1]	**(2)**
(ii)	$v = 55 + 12t$ 55 FT from their line [B1] 12 FT from their line [B1]	**(2)**
(b)	½ m $(v_f^2 - v_i^2)$ [B1] ½ m $(v_f - v_i)(v_f + v_i)$ [B1]	**(2)**
(c)	$66 = 27t + 3t^2$ $3t^2 + 27t - 66 = 0$ [B1] $t^2 + 9t - 22 = 0$ Solving [M1] t = 2 [A1]	**(3)**

Question Number	Answer	Mark
2 (a)	 [B1] $\sqrt{17^2 - 8^2} = 15$ [M1] Thus $\cos\theta = \frac{15}{17}$ [A1]	**(3)**
(b)	correct graph: cosine curve through (0, 2), (90,1), (180, 0), (270, 1) (360, 2) [B2] Graph with three points correct [B1] Scale – 0, 1, 2 marked on y axis and 0, 90, 180, 270, 360 marked on x axis $v = 1$ [B1]	**(4)**
(c)	$BC^2 = 6^2 + 16^2 - 2\text{x}6\text{x}16\cos 60^o$ [M2] $BC = 14$ cm [A1]	**(3)**

Question Number	Answer	Mark
3 (a)	$SA = 2\pi r^2 + 2r\pi h$ [M1] $SA = 2\pi(0.25)^2 + 0.5\pi \times 1.5$ [A1] $SA = 7\ \pi/8 = 2.75\ m^2$ [A1]	**(3)**
(b)	$120^o = \pi/3$ [B1] $1.5 \times \pi \div 3$ [M1] $\pi/2 = 1.57$ km [A1]	**(3)**
(c)	$300 \div 60$ [M1] $5 \times 2\pi$ [M1] $10\ \pi = 31.4$ rps [A1]	**(3)**

Question Number	Answer	Mark
4 (a)(i)	$(96x1)+(97x1)+(98x3)+(99x20)+(100x56)+(101x61)+(102x37)+(115x20)$ [M1] $= 20302$ [A1] Mean = $20302/199$ [M1] $= 102$ [A1]	**(4)**
(ii)	$(199 + 1)/ 2 = 100^{th}$ figure [M1] Evidence of cumulative frequency [M1] Median = 101 [A1]	**(3)**
(b)	Median [B1] Not affected by extreme values [B1]	**(2)**

Question Number	Answer		Mark
5 (a)	Draws tangent at $T = 500$	[M1]	
	Finds ΔT/ Δrpm (ft from graph)	[M1]	
	Rate of change =	[A1]	**(3)**
(b)(i)	Attempt to differentiate	[M1]	
	$a = 4t$	[A1]	**(2)**
(ii)	$a = 8$ m s^{-2}	[B1]	**(1)**
(c)	$\int_0^4 2t^2 + 5 \ \mathrm{d}t$	[M1]	
	$\left[\frac{2}{3}t^3 + 5t\right]_0^4$	[A1]	
	Using limits	[M1]	
	$\frac{128}{3} + 20 = 62.67$	[A1]	**(4)**

Question Number	Answer	Mark
6 (a)(i)	$t^2/(2\pi)^2 = \frac{l}{g}$ squaring [M1] Dividing by 2π [M1] $t^2 g/(2\pi)^2 = l$ [A1]	**(3)**
(ii)	$l = 2^2 \times 9.81/(2\pi)^2$ [M1] = 0.99396… oe [A1]	**(2)**
(b)	$36 = 20 \log_{10} \frac{V_{out}}{0.15}$ [M1] $\frac{9}{5} = \log_{10} \frac{V_{out}}{0.15}$ [M1] $10^{\frac{A}{20}} = \frac{V_{out}}{0.15}$ [A1] $V_{in}\ 10^{\frac{A}{20}} = V_{out}$ $0.15 \times 10^{1.8} = 9.4636$ [A1]	**(4)**
(c)	$0.5 = 1 - e^{\frac{-200}{C\times10^6}}$ [M1] $e^{\frac{-t}{C\times10^6}} = \frac{1}{2}$ $\ln\frac{1}{2} = \frac{-200}{C\times10^6}$ [M1] $C = \frac{200}{\left[\ln\frac{1}{2}\right]10^6}$ [A1] $C = \frac{200}{10^6 \times -.693} = -2.89 \times 10^{-4}$ [A1]	**(4)**

Guidance in most mathematical mark schemes

- **Types of mark**
    - M marks: method marks
    - A marks: accuracy marks
    - B marks: unconditional accuracy marks (independent of M marks)

- **Abbreviations**

  cao – correct answer only
  ft – follow through
  isw – ignore subsequent working
  SC - special case
  oe – or equivalent (and appropriate)
  dep – dependent
  indep - independent

- **No working**

  If no working is shown then correct answers normally score full marks.
  If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
  If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.
  If there is no answer on the answer line then check the working for an obvious answer.

- **Follow through marks**

  Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.
  Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

- **Ignoring subsequent work**

  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Probability**
  Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).
  Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
  If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.
  If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

- **Linear equations**
  Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

Example of mathematical mark scheme, including columns, ie: no accept, reject, but notes and working shown.
A level mark schemes just have column 1, 2 combined with 3 and 4.

Question Number	Working	Answers	Notes/Comments	Mark
3 (d)	10 + 3	13	**M1** for method. Accept 9 + 4 for M1 **A1** CAO receives 2 marks	**2**

All algebra in TNR italic
Long – signs, ie – not -
Laid out often each step in new (invisible) row so mark matches up
E-pen for GCSE requires us to put each separate question part in new MS box
Titles complete for each page, titles bolded and row shaded, as above
Mark in bold, Ors in caps and bold
Diagrams inserted – overlays?
Hard copy available as formatting took too much time between reading and meeting!
Equals signs line up in working.
FT marks - we have to include FT between stages, as if a student loses 1st mark, and their next answer depends on first part we can't penalise them for all the marks.

Ranges where required.
We need to specify number of decimal places required, and put value of ∏ on front.

Marked up against question paper – more parts required as the number of marks in original incorrect in places.