End of Year 12 Test analysis Name: \_\_kenan palmer\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| Question number | Topic | Marks out of: | My mark | Reasons for not achieving full marks (tick applicable) | | | | | | | |
| RTQ! | Calculation errors / accuracy | Lack of full/ correct labelling or “detailed reasoning” | Problem understand-ing the topic | Lack of revision | Failing to simplify answers | Misreading numbers (e.g. from previous answers) | Other (give details) |
| **Pure and Mechanics: 99 marks** | | | | | | | | | | | |
| **1** | Logs; indices; surds | 9 | 9 |  |  |  |  |  |  |  |  |
| **2** | Constant acceleration; velocity-time graph | 10 | 9 |  | X |  |  |  |  |  |  |
| **3** | Discriminant of quadratic equations | 7 | 7 |  |  |  |  |  |  |  |  |
| **4** | Small angle approx. | 5 | 5 |  |  |  |  |  |  |  |  |
| **5** | Connected particles (pulley); constant acceleration | 11 | 10 |  | X |  |  |  |  |  |  |
| **6** | Linear modulus equation | 3 | 3 |  |  |  |  |  |  |  |  |
| **7** | N2L, friction | 9 | 8 |  | X |  |  |  |  |  |  |
| **8** | Compound rates of change | 4 | 3 |  | X |  |  |  |  |  |  |
| **9** | Factor / Remainder theorem; maximum value | 8 | 0 |  |  |  |  | X |  |  |  |
| **10** | Geometry (circle theorems; trig.) | 6 | 6 |  |  |  |  |  |  |  |  |
| **11** | Proof by contradiction | 3 | 0 |  |  |  | X |  |  |  |  |
| **12** | Moments; modelling assumptions | 7 | 5 |  | X |  |  |  |  |  |  |
| **13** | Vector motion with constant velocity | 8 | 6 |  | X |  |  |  |  |  |  |
| **14** | Area between curves | 9 | 9 |  |  |  |  |  |  |  |  |
| **TOTAL** | | **99** | 80 |  |  |  |  |  |  |  |  |

Mean percentage per question achieved across the cohort: 

EoY12 Pure and Mechanics

General comments

The following general tips will greatly help you:

* Following the instructions given in the question, particularly showing **detailed reasoning**, i.e. full working out, when you are asked for it. You need to *convince* the person reading your working that you understand, which places a higher burden of proof on you than merely answering the question.
* Reading the question **carefully**.
* Large **diagrams** for all Mechanics questions, with all the relevant forces clearly labelled.
* Signposting your work (i.e. putting in those little **labels/comments** like “Resolving vertically”) to make sure your examiner knows that you deserve the method marks.

Comments about individual questions

**Q1:** No significant issues overall, other than to emphasise again that if you’re asked for detailed reasoning, you should show detailed reasoning!

**Q2:** **(b)** Your *sketch* should be a sketch, not a plot – you “only” need to have the significant points labelled and the shape between them correct. In this particular case, explicitly labelling and on your velocity axis is much clearer than having an evenly labelled scale.

That being said, you do have to remember important things like having units on labelled axes (and an awareness of scale doesn’t hurt!). Using a ruler is still recommended.

**(c)** Surprisingly many of you used kinematics formulae to find the distance travelled here when you could have used the area of the graph you’d just drawn. Not an issue per se, but a potential way you could have saved time. Also remember that a trapezium is a shape you can directly find the area of – you’re not restricted to triangles and rectangles!

**Q3:** This “show that” question is essentially a proof. If you’re trying to *prove* that a quadratic equation has no real roots, you can’t just write down that its discriminant is negative (unless there’s an “if” statement quantifying it very carefully). You should find its discriminant and show *from what you already know* that it must be negative.

Note that by itself is insufficient to conclude that ; you need to use the fact that is positive and *make it clear to the examiner* that you’ve noticed this given fact, rather than making a false assumption.

Be careful that you don’t assume too much; you’re told is positive, but not that it’s an integer.

**Q4:** Think about what you’re doing: you’re using approximations to attempt to solve this; therefore giving your answer as an exact surd makes no sense!

Make sure you give an explanation for why only one solution is the final answer. Words are essential here!

Showing detailed reasoning here means that if you use the quadratic formula, you need to show the substitution – quoting the formula then immediately writing down the simplified answer is insufficient.

**Q5:** **(a)** This should be a fairly familiar pulleys set-up; you need to use N2L twice, on each of A and B, then solve these simultaneous equations to find and . This was a “detailed reasoning” question so if you used any shortcuts, then we were generous in awarding a special case for correct answers without this full method.

**(b)** Think carefully about how you set up your equations of constant acceleration: *direction* is important! Here, A’s initial velocity is opposite to both its acceleration and the 18.9m it has to fall to the ground.

A few people put that when : remember that is when A reaches the *top* of its trajectory and is about to turn around, but when A reaches the ground it will still be travelling with a non-zero velocity.

You *don’t* need to separate the motion into sections for A reaching its highest point then back to the ground! That’s the beauty of a parabolic model: it can cope with exactly this scenario all in one go.

**Q6:** It was good to see some sketches here, showing an awareness of when the different cases arise.

Squaring both sides to say that a definitely-positive thing = another definitely-positive thing is a valid method here BUT can sometimes introduce extra false solutions so if you square an equation it’s worth double-checking your final answers back in the original equation at the end.

**Q7:** When you’re given a statement like , this is to *help you keep your calculations exact*! Rather than finding , use a right-angled triangle: if you have an opposite side length of , an adjacent of , what’s the hypotenuse? So what are and ? You’ll almost always be given a Pythagorean triple in a case like this!

**(a)** There were multiple instances of dividing the weight by here. Remember that the weight is always the resultant force, so it should be the hypotenuse of your right-angled triangle; your perpendicular components should always be *smaller* than the resultant force, so you need to *multiply* by or .

**(b)** Your answers should all be given to a *sensible* degree of accuracy; here is not that.

**Q8:** This is a compound rate of change question, so you should use the chain rule.

Be careful: does not imply that as you aren’t given any initial conditions.

**Q9:** **(a)** Surprisingly many people used polynomial long division here, with varying degrees of success. This is a valid method, but much more complicated than the factor/remainder theorems.

**(b)** A fair few people differentiated here to find the turning point; in a case like this I’d have hoped it’s not necessary! You should get used to quoting/using the fact that for a real number , we have . This was also a helpful quotable fact for Q11.

Given that you were explicitly asked for the greatest value, you should also justify why your value is indeed a maximum (commenting on the coefficient of is sufficient, but should be explicit).

**Q10:** **(a)** Use the diagram they’ve given you – rather than writing on your own label for the unknown lengths, call them or to make it clear what you’re doing. You don’t *have* to use area = , but it is valid.

**(b)** You can quote sector area = (in radians). Keep the numbers in your interim stages exact for as long as you can. Make sure that you specify your accuracy: is not strictly correct, but (to 2 s.f.) is.

**Q11:** There were a lot of incomplete arguments here. If you want to talk about a graph, you need to be clear what its equation is ( does not define a curve). If you mention a minimum point, you need to justify why the vertex is indeed a minimum. If your proof talked about needing two distinct roots for the quadratic to take negative values, this is only true when has a positive coefficient; you may have thought/known this, but if you haven’t actually written it down, we don’t know, so you can’t earn full marks.

**Q12:** **(a)** When you’re trying to find the range of things that make a situation possible, it helps to think about the extreme values and figure out what happens on either side. In this case, this means thinking about what happens if the plank is on the point of tipping about either of its pivots.

You should acknowledge the reaction forces; if they don’t appear anywhere in your answer, it’s impossible for an examiner to know whether you have just forgotten them or if you know you are looking at a limiting case.

Please, please, please **label** where you’re taking moments about, and in which direction. You should be doing this anyway, but especially here as this was a “detailed reasoning” question!

In this case it’s perfectly true that will appear in each term and thus be cancelled out of your final answer. However, if you multiply a *distance* by a *mass*, you haven’t actually calculated a moment, so you can’t get the method marks and therefore can’t get the final accuracy marks either!

**Q13:** Please underline your vectors!

**(a)** This is a “show that” question, so you should be extra clear in showing all your working out.

**(c)** Readthequestion carefully: starts from , with a 10-second delay compared to . So if you’re using as the parameter for seconds after starts from , then will have position vector .

**Q14:** It’s worth saying again: when you’re asked for detailed reasoning, you should show… guess what? Detailed reasoning! Here, this especially means showing the substitutions into your definite integral. Ideally this should also include a “” term (but you don’t have to show all the individual substitutions).

**Use the above to help you reflect on how your assessments went and set yourself targets below:**

What topics do I need to concentrate on in my revision?

Factor remainder theroum

Proof by contradiction

What can I do when completing my exam to ensure that I get maximum marks for each question? (e.g. highlighting key words, labelling calculations)

Make sure all simple calculations are correct

Make sure they are all to a suitable degree of accuracy