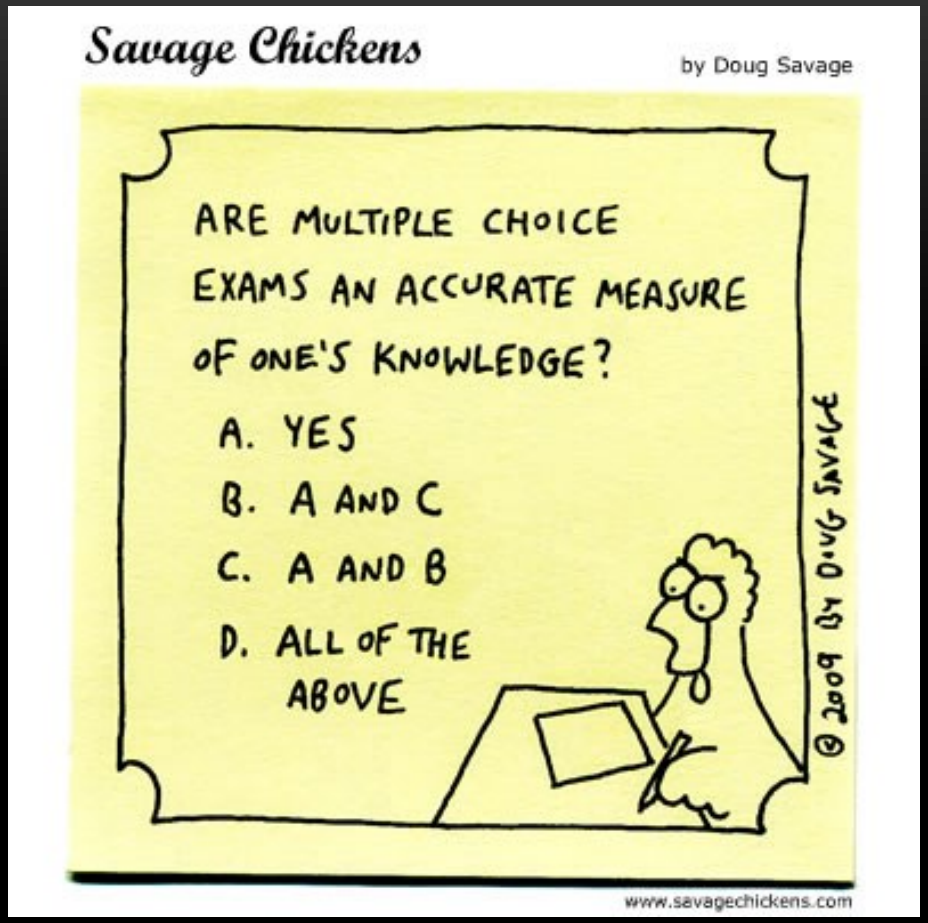
“Its not about how we make mistakes, but how we correct them.” -- KY

POST-MORTEM



Kia Yee

MCQ POST-MORTEM

MCQ POST-MORTEM

- **First question: Estimate the mass of the Solar System.**
- **Step 1: Estimate how massive the Sun is compared to the rest of the Solar System.**
- **Step 2: Look at your formula booklet.**
- **Step 3: Free mark.**

- **73% of Juniors got it correct vs 80% of Seniors**

MCQ POST-MORTEM

Most difficult (Juniors) : Question 35

An article suggests that for date X, the Moon will be visible after midnight in the constellation of Scorpius. Which of the following statements is most accurate?

A. As Scorpius is in the southern half of the celestial sphere, this event cannot be seen anywhere in the Northern Hemisphere.

B. “Midnight” must refer to Universal Coordinated Time.

C. “Midnight” must refer to 00h 00m 00s in local sidereal time.

D. The article is lying: the moon can never appear in the constellation of Scorpius.

E. None of the statements above are true.

MCQ POST-MORTEM

- **Most difficult (Seniors) : Question 25**
- In other words, for the same local solar time X at any location: **The altitude/azimuth of Arcturus in late October ≈ The altitude/azimuth of the Sun in late July.**
- Thus, if the Sun is known to have a RA around 08h in late July, which pair of coordinates could correspond to the RA/DE of Arcturus?
- RA: 02h 15m/ DE: +19° 10’
- RA: 05h 15m/ DE: +19° 10’
- RA: 08h 15m/ DE: +19° 10’
- RA: 11h 15m/ DE: +19° 10’
- RA: 14h 15m/ DE: +19° 10’

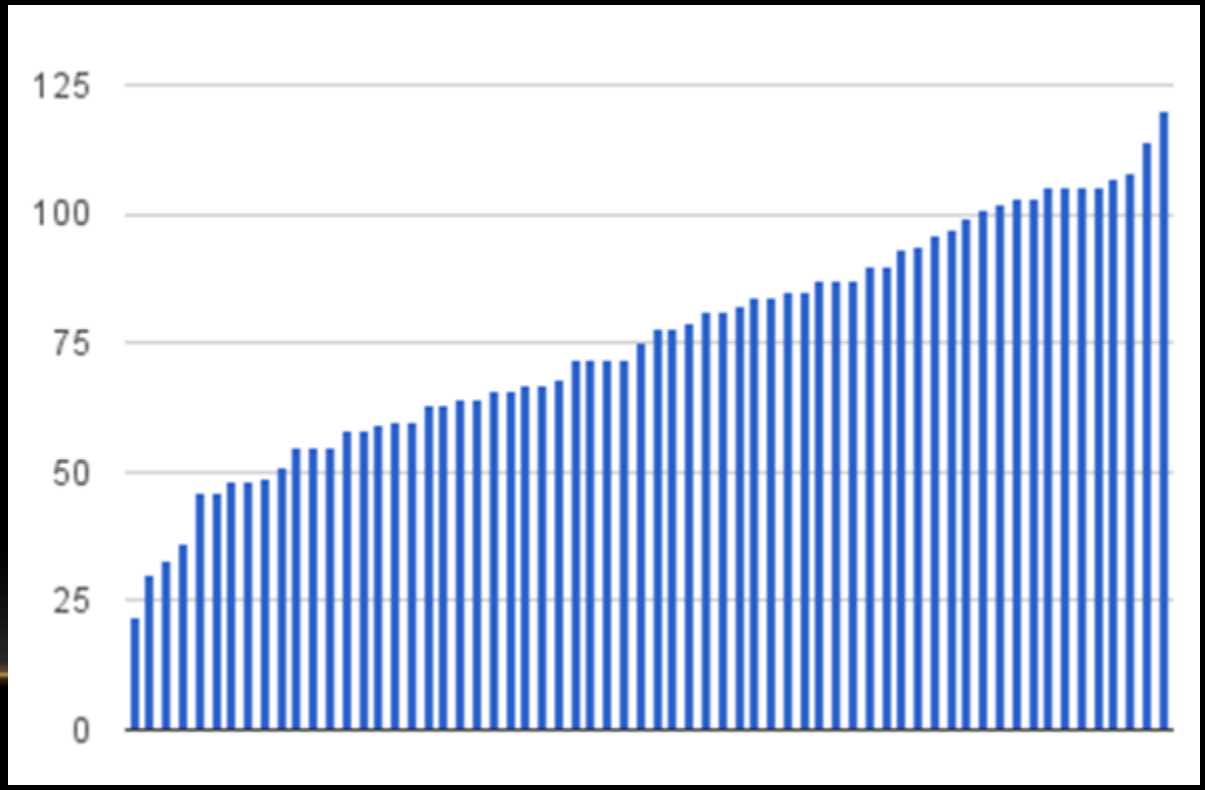
MCQ POST-MORTEM

- **Most easy (Juniors) : Question 47 – Before the Big bang:…**
- **Ans: We don’t know :P**

- **Most easy (Seniors) : Question 1**
- **Self-explanatory (read your formula book)**

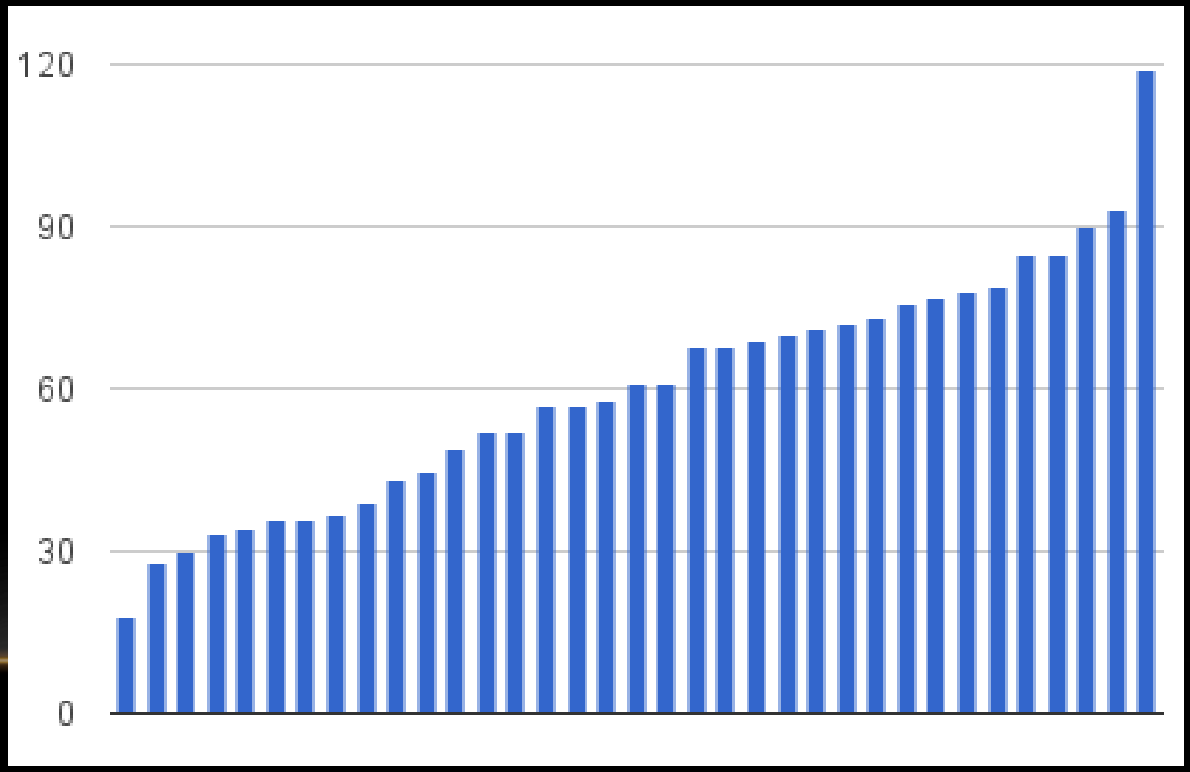
SCORING FOR JUNIORS (MCQ)

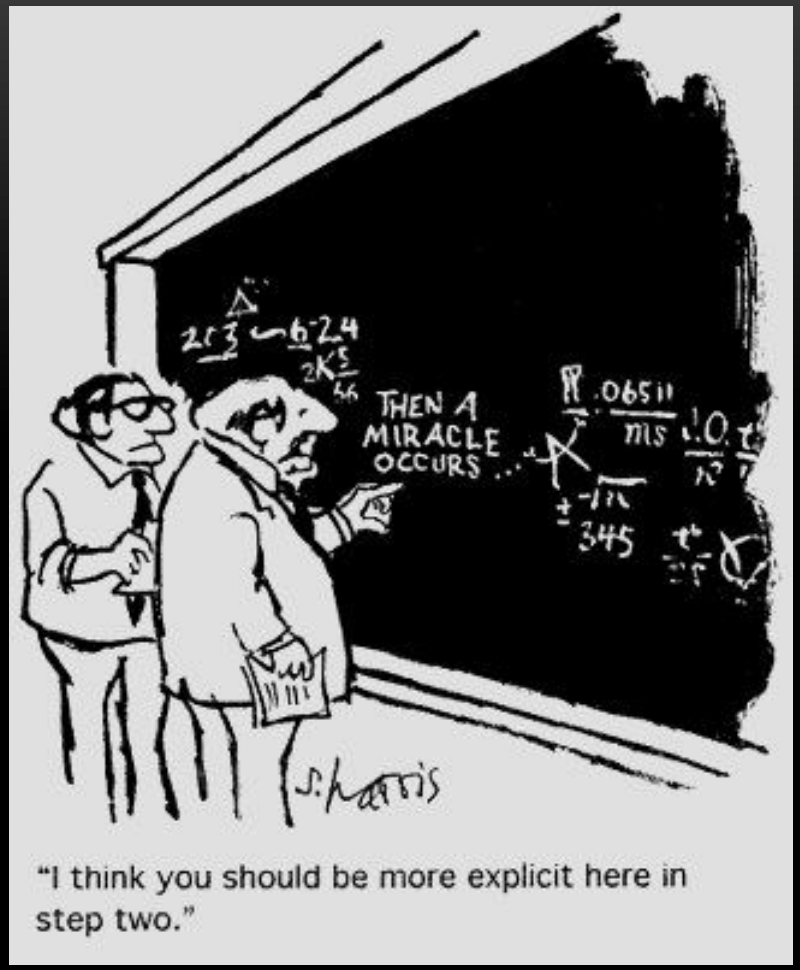
Max	120
Min	22
Mean	75.55
Median	76.5
Standard deviation	22.43



SCORING FOR SENIORS (MCQ)

Max	119
Min	18
Mean	59.97
Median	61
Standard deviation	22.16





"I think you should be more explicit here in step two."

QMs

DRQ POST-MORTEM BY QUESTIONS

GENERAL COMMENTS (DRQ)

- **Don’t anyhow staple your scripts! (i.e. don’t make your QM play treasure hunt for marks)**
- **Wrong/ lack of units**
- **Bad handwriting**
- **Overly Verbose Essays – mostly due to ‘Smoking’**
- **Poor presentation/ unexplained methods**

DRQ POST-MORTEM (JNRS Q1)

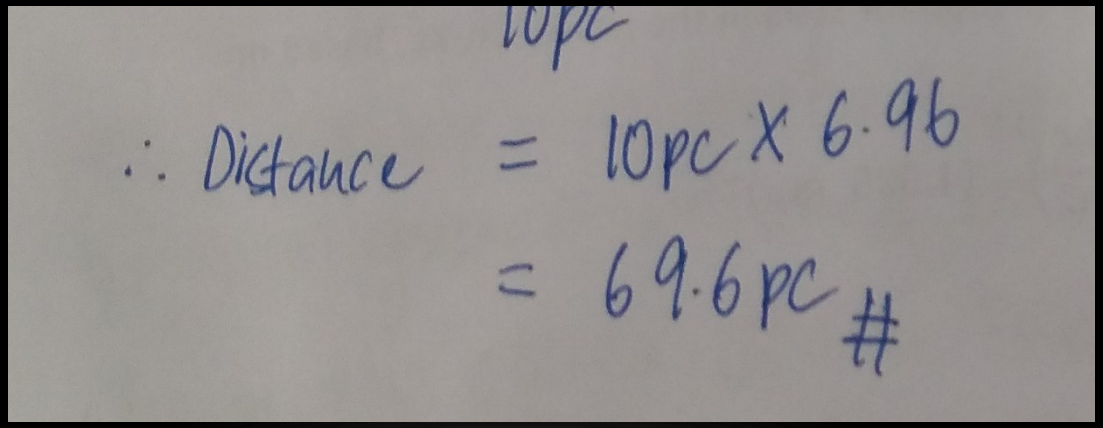
- **The good:**
- **Generally well done**
- **Most sources of error were identified**

- **The bad:**
- **NO neutron star is formed after Type Ia! (confused with Type II)**
- **Please check your values after you calculate them!**
- **Don’t smoke if you don’t know what a Cepheid variable is!**

DRQ POST-MORTEM (JNRS Q1)

- **The ugly:**

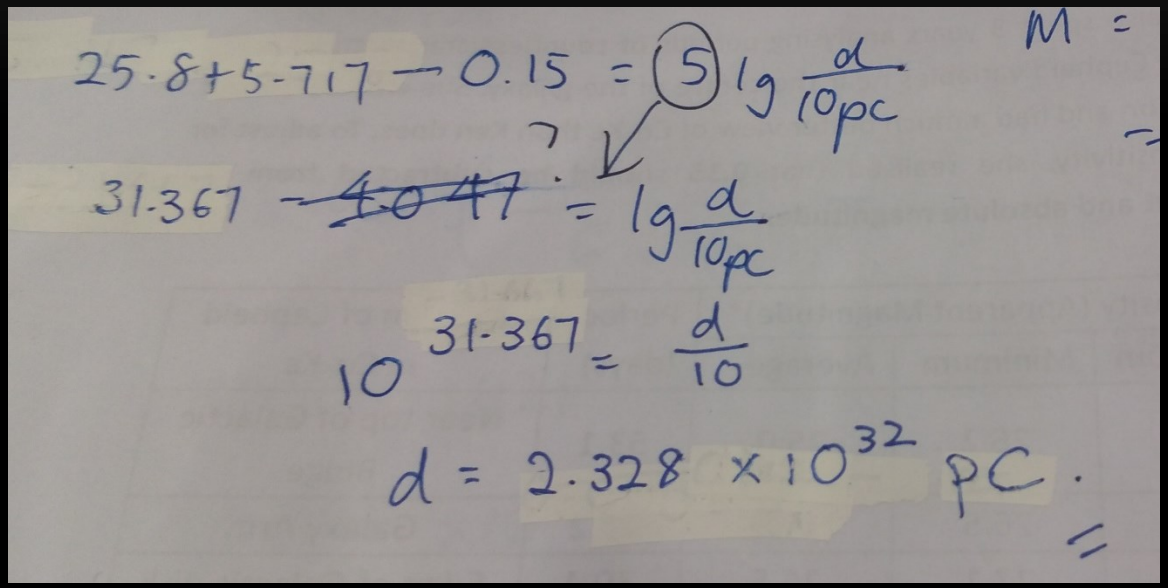
- **Distance to the Cα-kε galaxy is…**




Andromeda(And)
δ And
Andromeda Galaxy
M 110
M 32
Mirach
61 pc

Well played…

DRQ POST-MORTEM (JNRS Q1)



- **FYI observable universe is around 10^10 Pc**

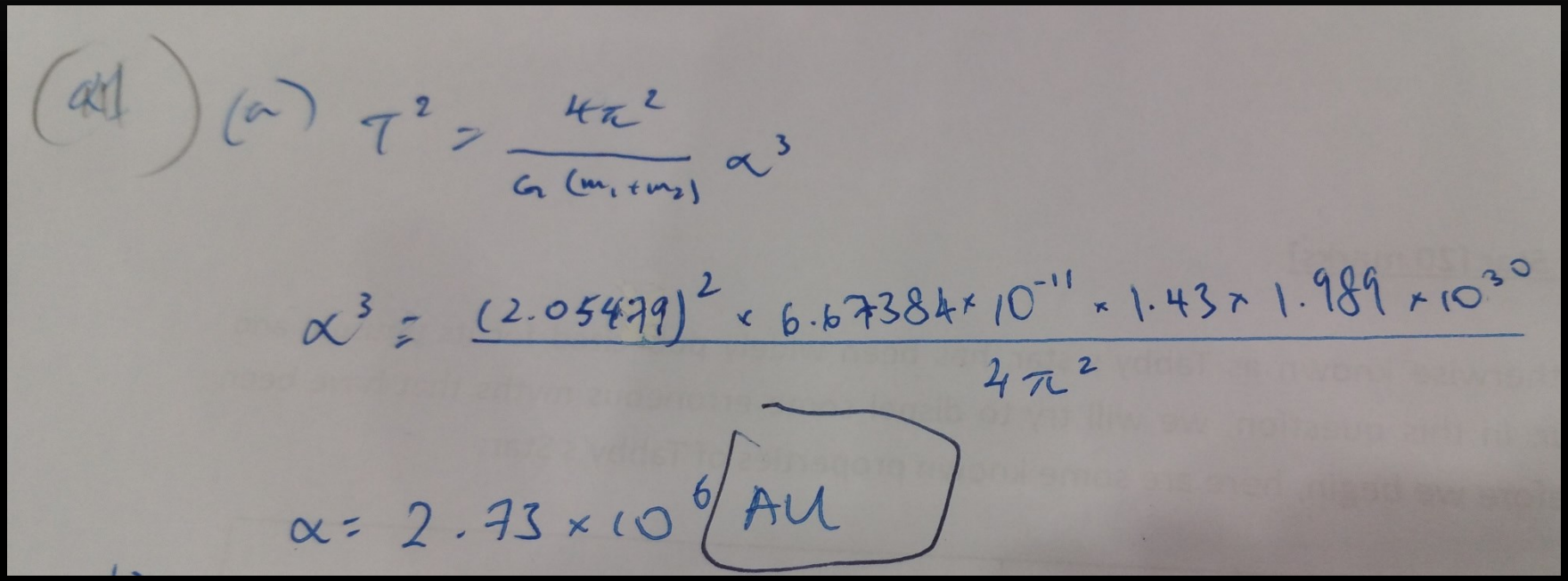
HOW CRAZY IS THIS VALUE?

Imagine the observable universe was shrunk to your height.
Where would Cα-kε be?

DRQ POST-MORTEM (JNRS Q2)

- This was the hardest question for Juniors
  - Unfamiliar context, required some out-of-the-box thinking
- Upside: many enjoyable/interesting answers were received…
- Don’t vomit math, appreciate the physical problem at hand!
  - If you don’t understand what’s going on, your answers will fly to the edge of the universe (and beyond)

HOW FAR IS A PLANET?

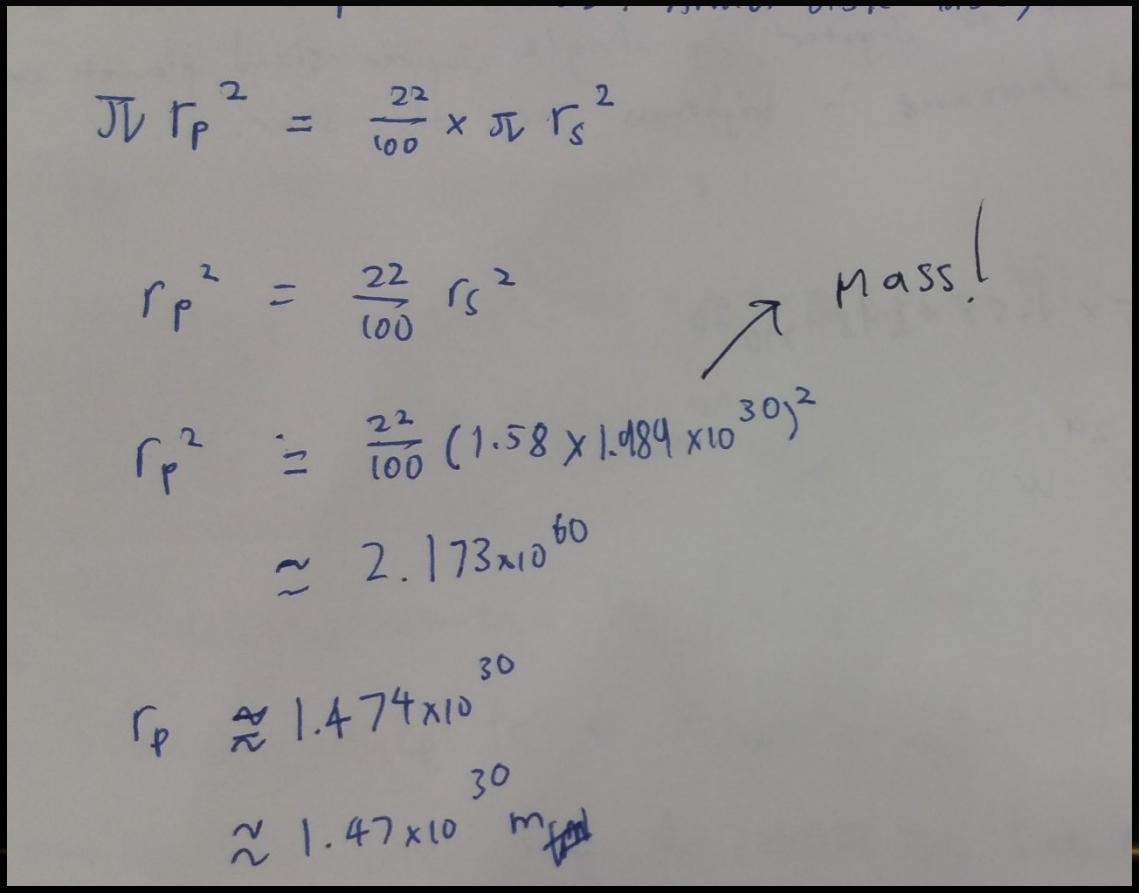


Well…

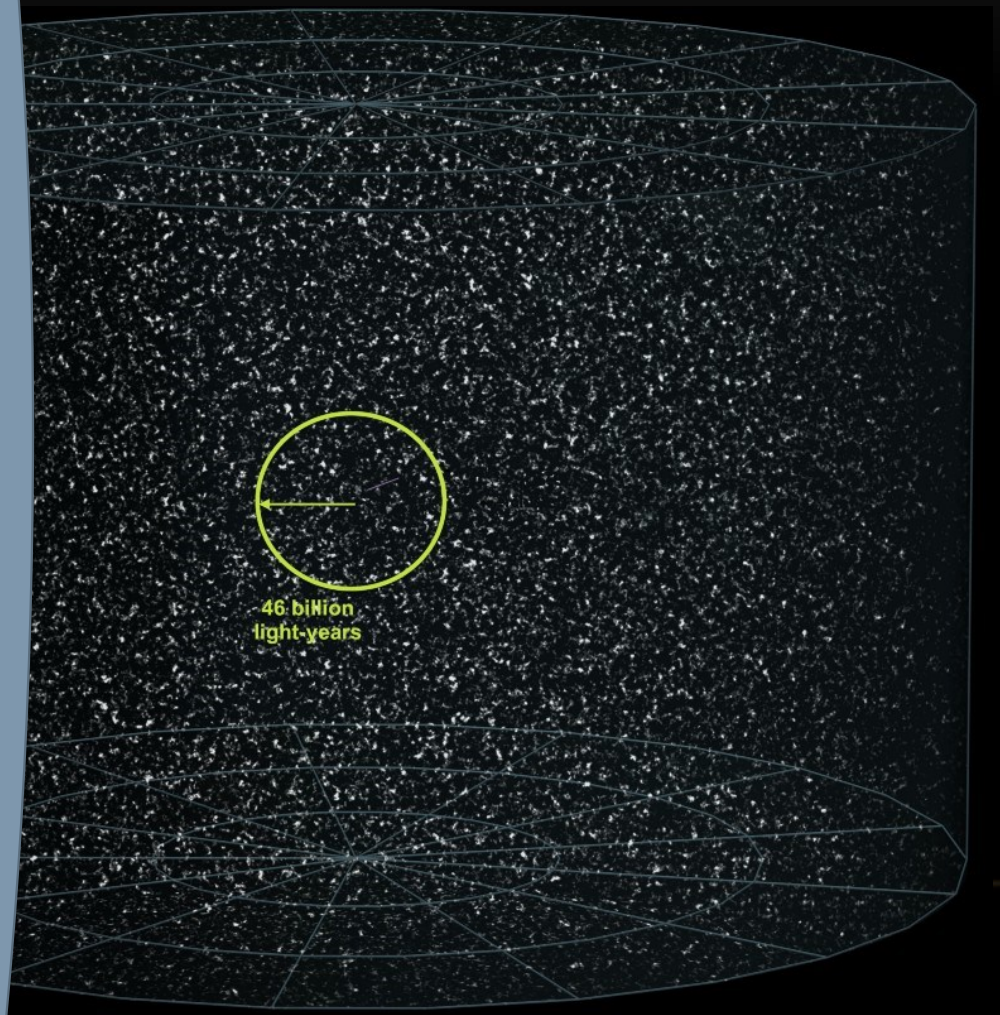
HOW FAR IS A PLANET?

- Neptune is 30 AU from the Sun
- Planet Nine (if it exists) is around 1000 AU from the Sun
- If you placed a planet this far away from the Sun…

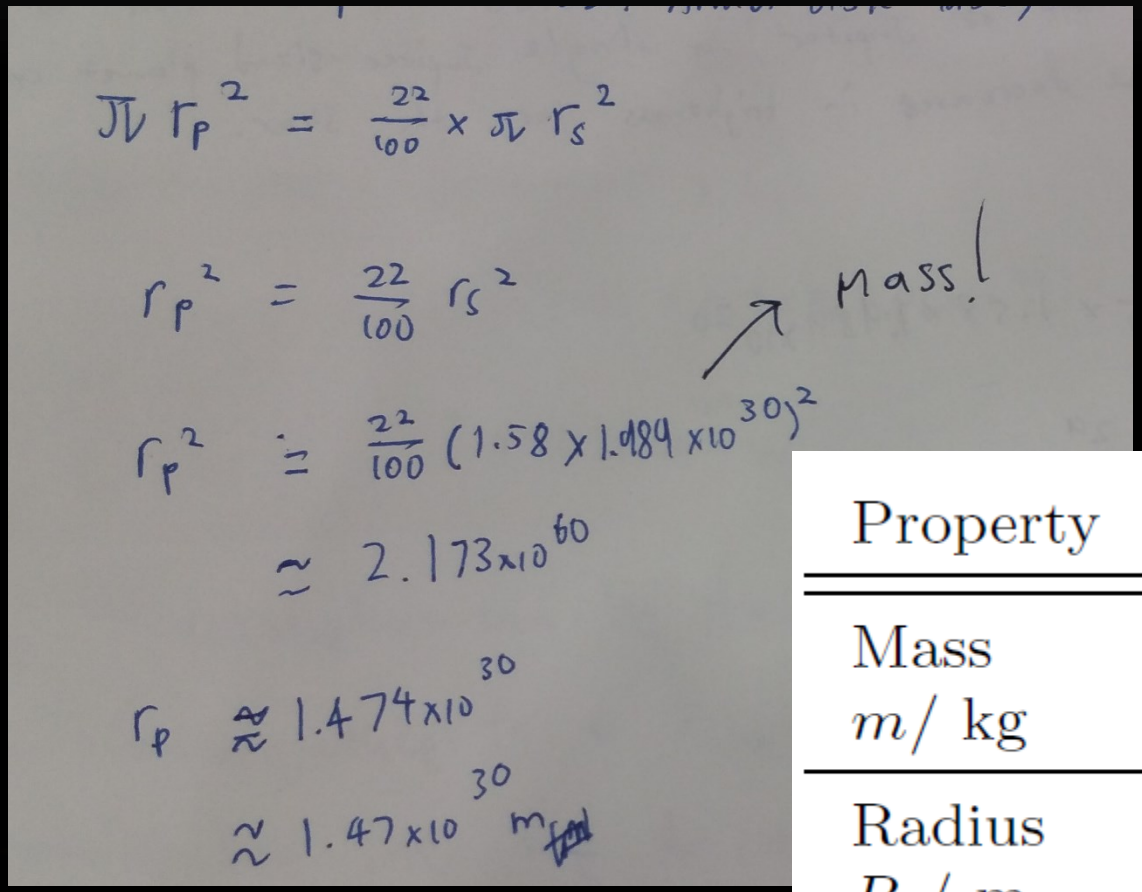
WHAT'S THE SIZE OF THE PLANET?



ZE OF THE PLANET?



WHAT'S THE SIZE OF THE PLANET?



Answers like this is the universe screaming at you to **check your work!**

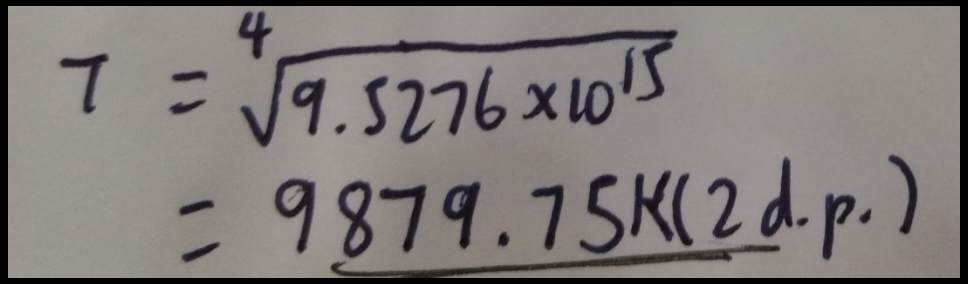
Property	Sun ⊙
Mass m/ kg	1.989×10^{30}
Radius R / m	6.963×10^{8}

HOW HOT CAN A PLANET BE?

$T_{planet} = [illegible]6403K$

HOW HOT CAN A PLANET BE?

We somehow got a bidding war…



HOW HOT CAN A PLANET BE?

We somehow got a bidding war…

$$T = \sqrt[4]{\frac{L}{\frac{1}{2}(4\pi R^2)\sigma}}$$

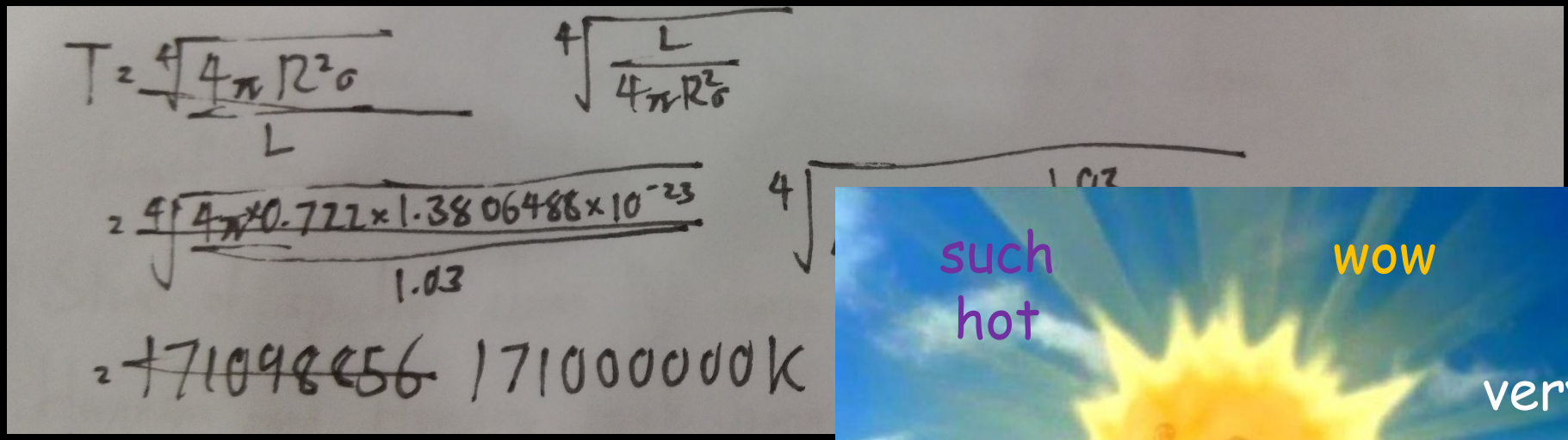
$$= \sqrt[4]{\frac{3.98 \times 10^{26}\ W}{\frac{1}{2}(4\pi(1.81 \times 7.149 \times 1}}$$

$$\approx 16100\ K$$

me is planetz!

HOW HOT CAN A PLANET BE?

Our winner charred everyone else to cinders



ULTIMATE PLANET

DRQ POST-MORTEM (JNRS Q3)

- **Generally OK**

- **Know your HR diagrams!**
  - **How is the lifecycle of a star cluster reflected on a HRD? Why?**

- **Note the log-scaled graph axes on a HR diagram!**

DRQ POST-MORTEM (JNRS Q4)

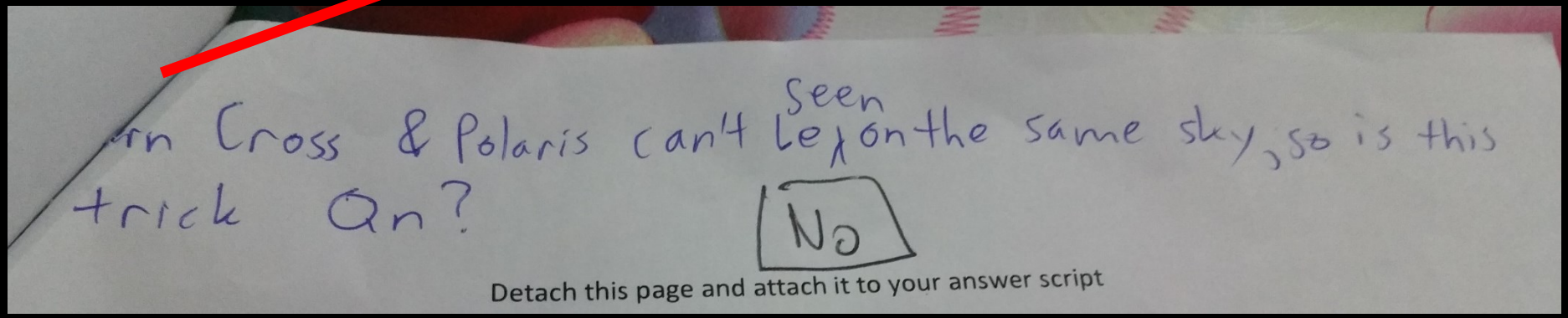
- **Also generally OK**
- **Units!**
- **Quite a few forgot to halve the time taken to get to Mars.**
  - **It's half an orbit!**

DRQ POST-MORTEM (JNRS Q5)

- Big variation in scores here.
  - Teams either died, or scored really well
- Many inventive night sky constellations were observed…
- The best preparation: Go out at night!
  - One of the few exams where burning midnight oil actually helps…

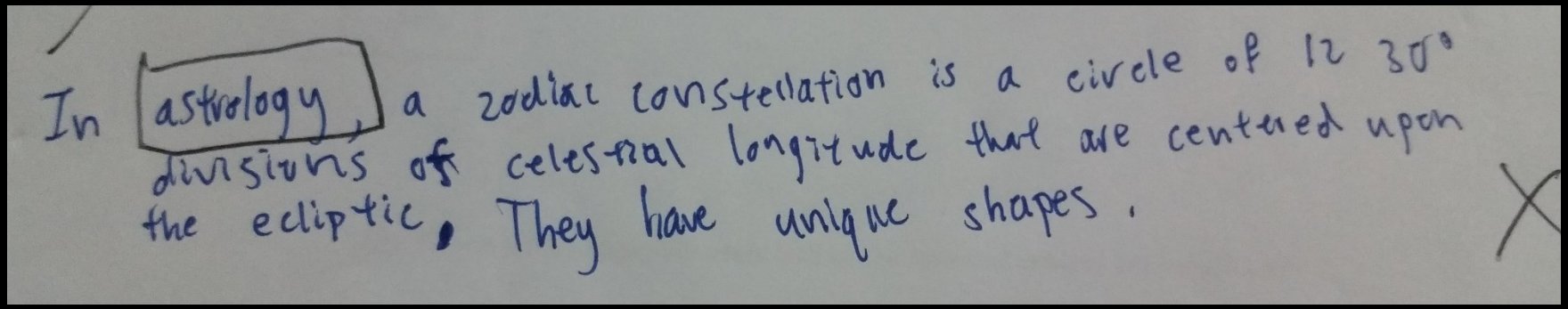
EXAMPLES WERE TOO EMBARRASSING TO SHARE

Bad stapling example




W
N
S
E
Jupiter
Arcturus
Spica
Mars
Vega
Saturn
Rigil Kent
Altair

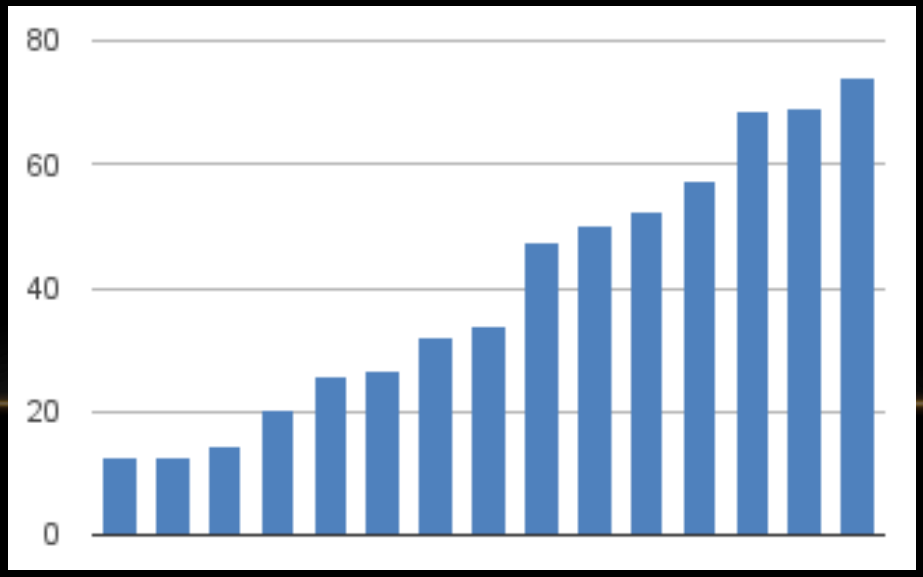
ASTRONOMERS: DO NOT DO THIS!



We are doing astronomy, not astrology…

SCORING FOR JUNIORS (DRQ)

	Q1	Q2	Q3	Q4	Q5
Min	3	1	1	0	0
Max	18.5	12	16.5	17	17.5
Average	10.571	5.911	9.357	7.357	7.607
Median	10	5.75	10.75	4.5	5.25
SD	4.885	3.655	5.600	6.368	6.340



DRQ POST-MORTEM (SNRS Q1)

- I (unfortunately) killed everyone here: no one passed
- The question tried to showcase some key skills in astronomy…
- Understand your math!
  - If you read the question carefully, everything else except density is constant : use proportionality!
  - $R_J \propto \frac{1}{\sqrt{\sigma}} \rightarrow R_J{}' = n^{-1.5} R_J$
  - When the cloud is forced to compress, the Jeans length shrinks more than the cloud does : cloud fragments into several pieces.

DRQ POST-MORTEM (SNRS Q2)

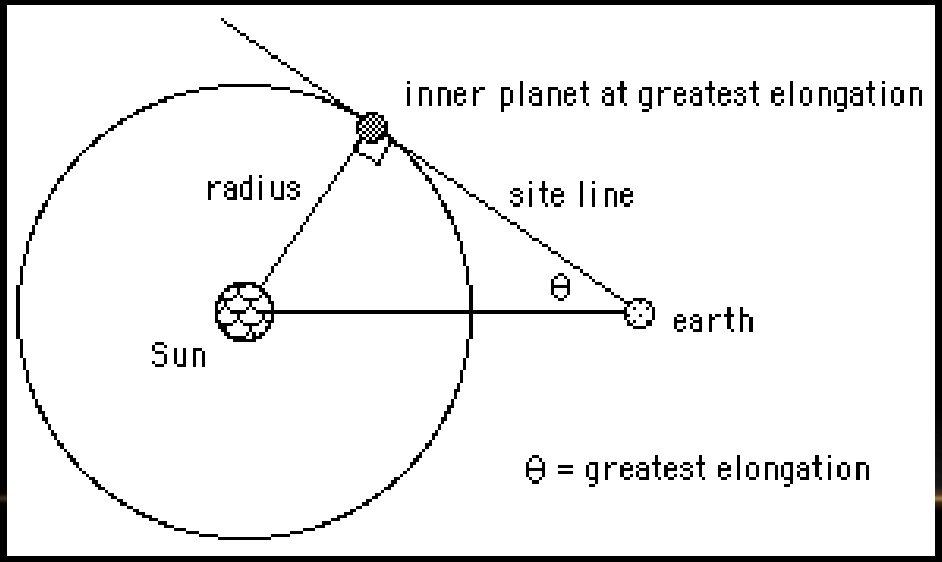
- **Seniors Question 2**
- **No major errors here**
  - **Line of best fit is a straight line.**
  - **Be comfortable with manipulating algebra**
- **No, you don't need to do the integral**
- ***Why is the other estimated value of α so wildly wrong?***

DRQ POST-MORTEM (SNRS Q3)

- Seniors Question 3
- Poorly done
  - Most teams could do the proving
  - Scared away by the integration (which can take time)
  - Or simply do the trapezium method
- Read the question
  - Bandwidth and peak wavelength

DRQ POST-MORTEM (SNRS Q4)

- **Seniors Question 4**
- **Greatest Elongation**
- **The second change in velocity is at the aphelion**
- **The total change in mass is in fact a linear sum**



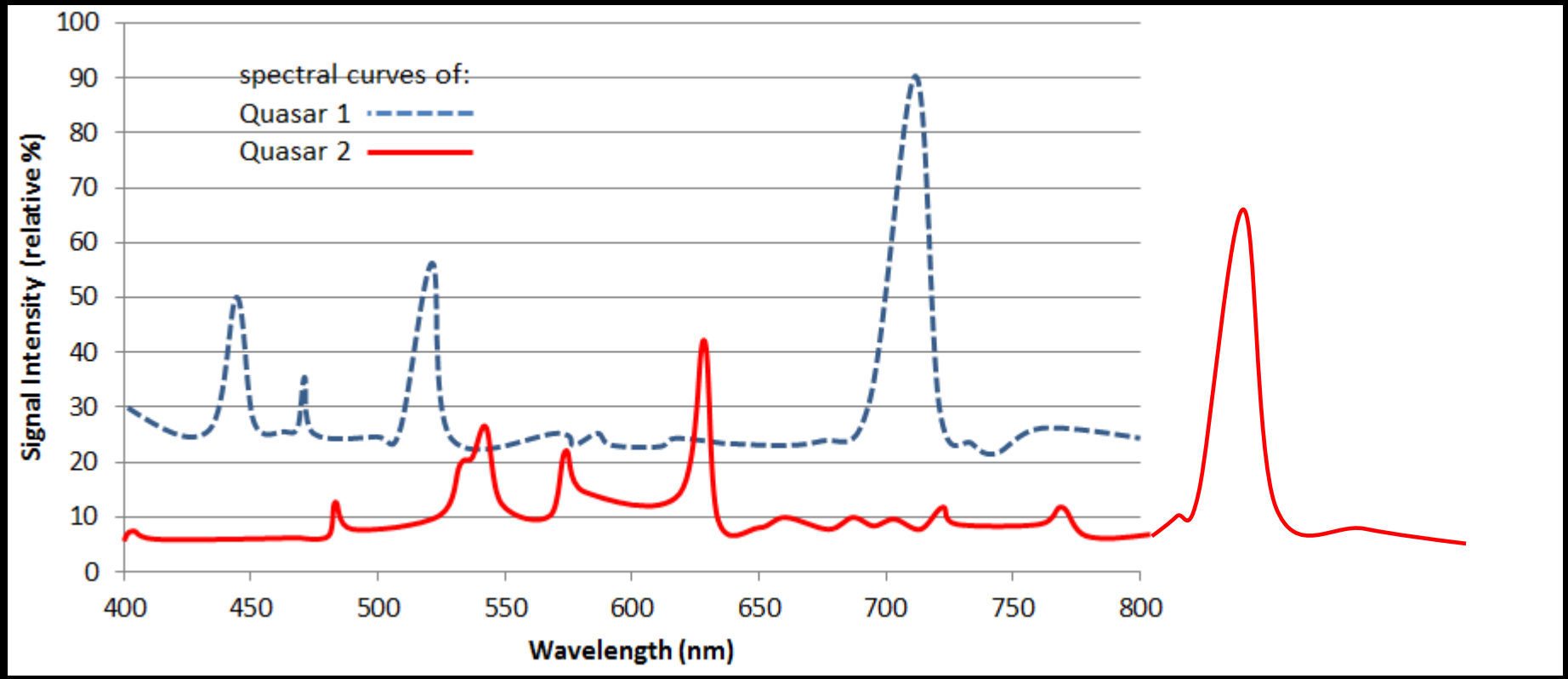
DRQ POST-MORTEM (SNRS Q5)

- **Teams who were familiar with the question scored more than 20 marks (21, to be precise)**
- **Nobody got 0 marks (Hurray!)**

- **Common errors:**
- **Subbing in wrong values/ using wrong formula**
- **Conceptual errors/ ‘smoking’ (to be elaborated)**

DRQ POST-MORTEM

- **‘Giveaway’ troll question: not so simple after all**



DRQ POST-MORTEM (SNRS Q5)

Specific problems:

- **Teams who do not know about redshift or didn't make the connection that interstellar hydrogen is responsible for the Lyman alpha forest did poorly in general, and had cringe-worthy explanations**

- **Many improbable reasons for a star at 100 parsecs moving away from us at 200km/s include 'Nearby' galaxy/ black holes**
- **Even the best teams lost marks due to this mistake!**
- **Ans: It's a Runaway star!**

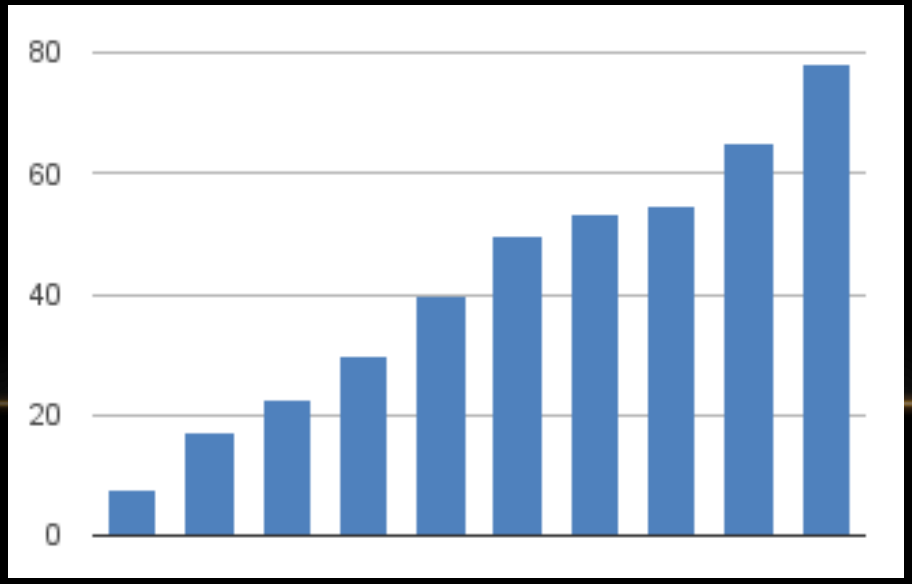
DRQ POST-MORTEM (SNRS Q5)

- **Bonus (Juniors): best plot twist by NUSH Team 2, summarized:**
- **F. Igor Nance is Ken's evil alter ego feigning ignorance (caught the pun?) and Ken is Carrie's father who time travelled from the future to persuade Carrie to turn the ISS into a death star to save the world from a diabolic person.**
- **(p.s. jokes aside, your letters all received full credit for interesting but accurate answers!)**

- **Bonus (Seniors): Scariest thing about the final question**
- **A. A lot more theory and explanations than expected**

SCORING FOR SENIORS (DRQ)

School	Q1	Q2	Q3	Q4	Q5
Min	0	0	0	0	1.5
Max	9	14	**20**	15	**21**
Average	5.75	9.2	8.8	6.5	11.475
Median	8	10.5	8.5	7	10.75
SD	3.28	4.18	6.84	4.58	7.03

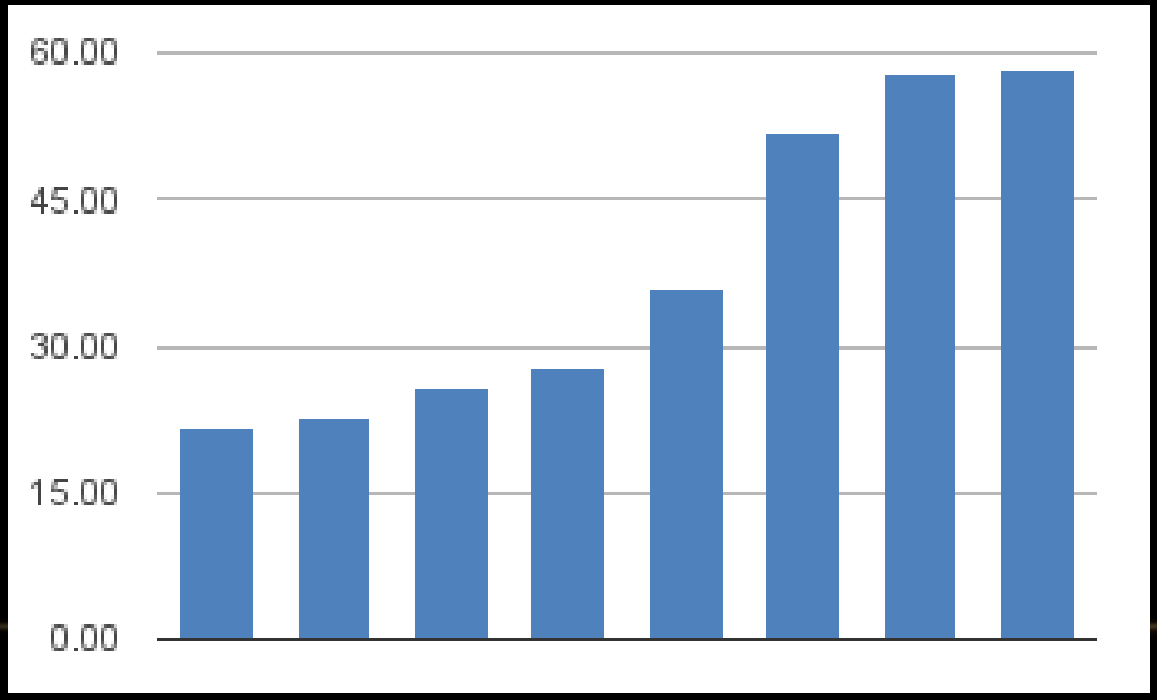


Will your mistakes counterweigh your achievements?

OBS ROUND POST-MORTEM

SCORING FOR OBS

Top score:	58.46
2nd best:	58.08



OBS POST-MORTEM

What happened???!!!

OBS POST-MORTEM

- Prepare in advance…
- Your practical experience (or lack thereof) shows
  - Know your scope!
- Do not look for things that are difficult to find/ see (e.g. M4) UNLESS you have a really good scope + skills
- For schools with club scopes: maintenance is essential
- Teamwork is ESSENTIAL: Do not stare at books while one person handles the scope