# Math SL PROBLEM SET 73

**Section A (Short Answer)**

1. **(T3.5 - R) (CI)** Solve the following trigonometric equations on the domain of $0 \leq x \leq 2\pi$.

   **(Cirrito 10.4, p359)**

   a. $\sin^2(2x) - \frac{1}{4} = 0$ b. $\tan^2(\frac{1}{2}x) - 3 = 0$

2. **(V4.1 - R) (CI)** PQRS is a trapezium with $\overrightarrow{PQ} = p$, $\overrightarrow{PS} = s$ and $\overrightarrow{SR} = 3p$. T is the midpoint of [QR]. Draw a diagram to visualize this information and then express the following vectors in terms of $p$ and $s$:

   **(Cirrito 12.3, p415)**

   a. $\overrightarrow{PR}$ b. $\overrightarrow{QR}$ c. $\overrightarrow{PT}$ d. $\overrightarrow{ST}$

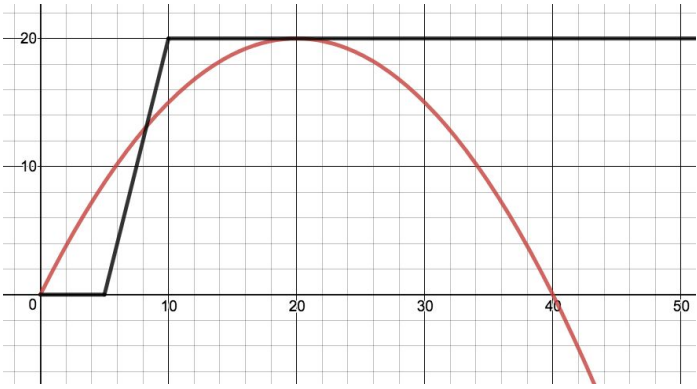
3. **(T3.1 - R) (CA)** Let $A$ and $B$ be events such that $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$ and $P(A \cup B) = \frac{5}{12}$.

   **(Cirrito 15.2, p510)**

   a. Find $P(A|B)$ b. Find $P(A|B')$ c. Are $A$ and $B$ independent? Why/why not?

4. **(CA6.6 - E) (CA)** A car starts from rest with a velocity $v$ meters/sec at any time $t$ seconds given by $v(t) = -\frac{1}{20}t^2 + 2t$. Five seconds later a second car starts from rest from the same position as the first car, accelerates uniformly to a speed of 20 m/s in those 5 seconds and then maintains this constant speed. This velocity-time relationship for Car 2 is shown to you by the black graph.

   **(Cirrito 22.6, p764)**




   a. Find the distance between the two cars when the first car comes to rest again.
   b. Find when the second car overtakes the first car.

5. **(F2.6 - R) (CI)** Consider the function $f(x) = \ln(x) - \ln(1 - x)$.

   **(Cirrito 73, p220)**

   a. Find the values for $x$ for which $f$ is defined (that is, find the domain of $f$)
   b. Find the range of $f$ (HINT: Find the inverse …… why does this help?)
   c. Find the instantaneous rate of change at the point where $x = \frac{1}{2}$.

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6. **(SP5.9 - N) (CA)** Seeing that you are all conducting experiments and taking measurements for your science IAs …… The distribution of errors in measurement in using an instrument to measure length is normally distributed with a mean of +1 cm (meaning 1 cm over) and a standard deviation of 2 cm. What is the probability of your measurement

**(Cirrito 17.2, p568)**

   a. underestimating the true length
   b. being correct to the nearest cm?

   But of course, as luck would have it, I have some data from last year's class and their ability to perform measurements with the same instrument. They were at most 2 cm over the true length 69.123% of the time and were at most 0.5 cm under the true length 43.358% of the time.

   c. What was the mean and standard deviation of last year's class measurements?

   d. Which class was more
      i. accurate? How do you know?
      ii. precise? How do you know?

**Section B (Extended Response/Investigation)**

7. **(CA6.5 - N) (CI)** Let $f(x) = (x - 2)^2$ on the domain of $x \geq 2$.

**(Oxford 9.6, p318)**

   a. Determine the equation of $f^{-1}$.
   b. Find the volume of the solid of revolution formed by rotating the function $f^{-1}(x)$ about the $x$-axis between $x = 0$ and $x = 4$. (You may verify on your calculator)

8. **(CA6.5 - E) (CI)** For the function $g(x) = \frac{ln(x)}{x^2}$ where $x > 0$, determine (if they exist):

**(Cirrito 20.2, p649)**

   a. the $x$-intercept(s)
   b. How do you know that the function has a horizontal asymptote at $y = 0$?
   c. the coordinate(s) of the stationary point(s)
   d. the $x$-coordinate(s) of the inflection point(s)
   e. Sketch the graph of $g(x)$.