

Math SL PROBLEM SET 34

Section A (Short Answer)

- (F2.7, A1.2 - E) (CI)** Solve the exponential equation $2^{x-2} = 5^{2x+3}$. **(Cirrito p226, Ex 7.22)**
- (V4.2 - N) (CI)** The lines L and M have vector equations as follows: **(Cirrito 12.6.1, p432)**

Line L: $(x,y,z) = 3\mathbf{i} - 2\mathbf{j} + 5\mathbf{k} + \lambda(-\mathbf{i} + 3\mathbf{j} - 5\mathbf{k})$
Line M: $(x,y,z) = 14\mathbf{i} - 20\mathbf{j} + 6\mathbf{k} + \mu(3\mathbf{i} - 4\mathbf{j} - 3\mathbf{k})$
 - Show that lines L and M meet and find the position vector of their intersection point.
 - Show that lines L and M are perpendicular.
- (C6.3 - N) (CA)** Graph the function $g(x) = e^{-0.25x}\cos(x)$ on the domain of $-\pi < x < 2\pi$ on your TI-84 and hence determine: **(Cirrito 20.2.2, p651)**
 - the x -coordinate(s) of the extremas.
 - the domain interval(s) in which the function values are increasing.
 - the estimated value(s) of the x -coordinates of the inflection point(s).
 - the domain interval(s) in which the function is concave down.
 - Include a sketch, labelling the important points from (a) and (c).
- (SP5.7, SP5.8 - N) (CA)** The random variable X is binomially distributed with 4 trials and a probability of success of 0.425 on each trial. *(NOTE: We do not KNOW what the variable actually is, so if you need to - make up a variable/event ... say like our event is the number of students who can complete this question in less than 10 minutes).* Now determine:
 - $P(X = 1)$
 - $P(X < 1)$
 - $P(X \leq 2)$
 - $P(X = 3 \mid X \geq 2)$

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5. **(T3.5 - E) (CA)** Solve the equation $2 \sin^2(x) + 5\cos(x) = -1$ on the domain of $0 \leq x \leq 4\pi$. Show the algebraic analysis that leads to your solution. **(Cirrito 10.2.2, p332)**
6. **(SP5.7 - N) (CA)** The random variable, X , has a probability distribution as shown on the table:
(NOTE: Again, we do not KNOW what the variable actually is, so if you need to - make up a variable/event ... say like the time to complete this question) **(Cirrito 16.1, p527)**

$X = x$	5	10	15	20	25
$P(X = x)$	$\frac{3}{20}$	$\frac{7}{30}$	k	0.3	$\frac{13}{60}$

- Find the value of k .
- Find $P(x > 10)$
- Find $P(5 < x \leq 20)$
- Find the mean (now called **expected value**) and the standard deviation and the variance.

Section B (Extended Response/Investigation)

7. **(C6.1 - N) (CA)** For the following functions, determine the value of $f(2)$ as well as determining an expression for $f(2 + h)$, then use these values to determine the value of the difference quotient. **(Cirrito 18.3, p592)**
- $f(x) = \frac{1}{x+3}$
 - $g(x) = 2x^2 + x$
 - Given your work in Q(b), let h equal the following values ($h = 1, 0.5, 0.1$, and 0.01) and determine the value of the difference quotient in each case.
 - What does the difference quotient represent, geometrically?
 - What does $\lim_{h \rightarrow 0} \frac{f(2+h)-f(2)}{h}$ represent, geometrically?

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8. **(V4.3 - N) (CA)** The position vector of a ship (the Jolly Math) from its starting point at Port

Cairo is given by $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ 20 \end{pmatrix} + t \begin{pmatrix} 12 \\ 16 \end{pmatrix}$. Distances are in kilometers and speeds are in km/hour. The parameter, t , is time after midnight. **(Cirrito 12.7.2, p452)**

- Make a sketch, showing the position of the port (Port Cairo) and the path of the ship, the Jolly Math).
- Find the position of the Jolly Math after 2 hours.
- What is the speed of the Jolly Math?

Another ship (the Sunken Grades) is at sea at the location $\begin{pmatrix} 41 \\ 68 \end{pmatrix}$ relative to the same Port Cairo, but the Sunken Grades ship has STOPPED!!!

- Show that if the Sunken Grades ship does NOT start to move, the two ships will collide.
- Find the time of the potential collision.
- To avoid collision, the Sunken Grades ship is ordered to leave its position and starts moving at a velocity of $\begin{pmatrix} 15 \\ -36 \end{pmatrix}$ one hour after the Jolly Math started. Find the position vector of the Sunken Grades ship.
- How far apart are the ships after two hours since the start of the Jolly Math?