

Math SL PROBLEM SET 53

Section A (Skills/Concepts Consolidation)

1. **(V4.1 - E) (CI)** A unit vector is defined as a vector whose **length is one unit**. Given the following vectors, find their respective unit vectors. **(Cirrito 12.5.2, p430)**

a. $\vec{AB} = \begin{bmatrix} -3 \\ 5 \end{bmatrix}$ b. $\vec{AB} = \begin{bmatrix} 5 \\ 2 \\ 4 \end{bmatrix}$

2. **(SP5.6 - R) (CA)** Mr D. walks home after teaching and takes either Road 253 or Road 206 to get home. He varies his route so that he takes Road 253 two-thirds of the time. If he walks along Road 253, he arrives home before 6:00 pm 90% of the time. If he takes Road 206, he gets home by 6:00 pm only 60% of the time. What is the probability that: **(Oxford 3.5, p89)**

- he gets home after 6:00 pm?
- he travelled along Road 206, if he gets home before 6:00 pm?

3. **(A1.3 - R) (CA)** Consider the expression $(-2x + \frac{1}{x^2})^7$, **(Cirrito 4.1.2, p100)**

- Find the first three terms of this expansion.
- Find the constant term of this expansion OR justify that it does not exist.

4. **(SP5.8 - R) (CA)** The random variable X is binomially distributed with 7 trials and a probability of success of 0.375 on each trial. Determine: **(Cirrito 16.3.4, p544)**

- $P(X = 4)$
- $P(X > 2)$
- $P(X = 4 \mid X > 2)$
- The expected value and variance of X .

5. A poll of 20 students was taken at CAC to see whether they support banning the sale of plastic water bottles on campus. It is known that approximately 60% of the students support the ban.

(Cirrito 16.3.4, p544)

- What is the probability that 5 students support the ban?
- What is the probability that none students support the ban?
- What is the probability that at least 2 students support the ban?
- Find the mean and standard deviation of the distribution.

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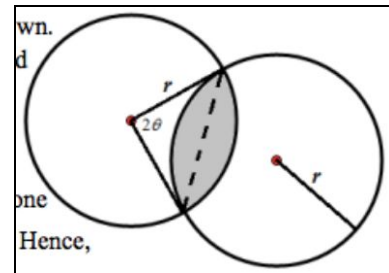
Section B (Skills/Concepts Practice)

6. **(C6.2, C6.6 - N) (CI)** The position at t seconds of a particle moving along a **straight line path** (i.e. forwards or backwards) is given by $s(t) = t^3 - 6t^2 + 9t$, where s is measured in meters and $t \geq 0$. **(Cirrito 21.3, p694)**

- Find the position at $t = \{1, 2, 3, 4\}$.
- Where is the particle at $t = 3$ seconds? What is its velocity at this time?
- How far has the particle travelled in the first 2 seconds? In the first 4 seconds?
- Is the particle moving forwards or backwards at $t = 2$? How do you know?
- Determine the speed of the particle at $t = 2$ s.
- Determine when the particle's speed is increasing
- Determine when the particle's acceleration is 0.

7. **(T3.1 - N) (CA)** Two circles with the same radius, r , intersect as shown. The angle subtended by the common chord (dashed line in diagram) at the center of each circle is 2θ . **(Cirrito 9.7.3, p311)**

- Find an expression in terms of r and θ for the shaded area.
- If the shaded area is equal to $\frac{1}{4}$ of the area of one of the two circles, show that $8\theta - 4\sin(2\theta) = \pi$.
- Hence, find θ accurate to three significant figures



8. **(C6.2 - N) (CA)** For our “parent functions” $y = 1/x$, $y = e^x$ and $y = \ln(x)$; **(Cirrito 19.3, p618)**

- Graph each function using DESMOS (sketch into your notebooks)
- Sketch what you predict the derivative of each function should look like.
- Use DESMOS to graph the derivative.
- Use SYMBOLAB to find the equation of the derivative of each function

9. **(C6.4 - N) (CA)** Use SYMBOLAB to help with the following investigation: Working the composite function $g(x) = \sin(f(x))$, find: **(Cirrito 19.3.6, p621)**

- The derivative of $y = \sin(x)$
- The derivative of $y = \sin(2x + 4)$
- The derivative of $y = \sin(4x - 5)$
- The derivative of $y = \sin(2x^2 + 5)$
- The derivative of $y = \sin(2x^2 - 2x + 5)$
- The derivative of $y = \sin(\ln(x))$
- Make a general conclusion about the derivative of $g(x) = \sin(f(x))$