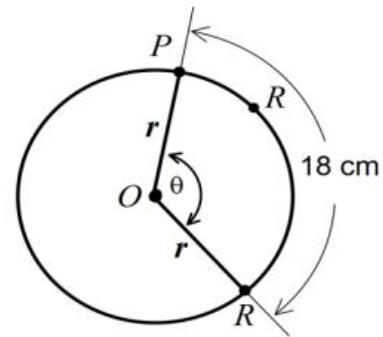


Math SL PROBLEM SET 48

Section A (Short Answer)

1. **(T3.1 - R) (CA)** The diagram shows a circle with a radius of r and its center at O . The central angle $\angle POR$ measures θ radians. The length of the minor arc PR is 18 cm. The area of the sector $OPSR$ is 108 cm^2 . Find the value of r and the value of θ . **(Cirrito 9.7, p309)**



2. **(C6.1, C6.2 - N) (CI)** Find the equation of the lines that are tangent to the following functions at the given points: **(Cirrito 20.1, p646)**

- $f(x) = \ln(x^2 + 1)$ at the point $(2, \ln 5)$
- $g(x) = e^{2-x^2}$ at the point $(1, e)$
- $h(x) = \sin\left(\frac{1}{x}\right)$ at the point where $x = \frac{2}{\pi}$.

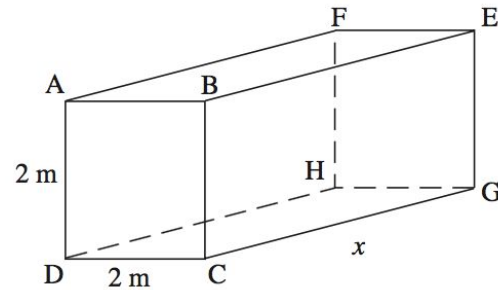
3. **(A1.3 - R) (CI)** Given the expression $(2 + x)^4$; **(Cirrito 4.1, p95)**

- Expand $(2 + x)^4$ and simplify your result.
- Hence, find the term in x^2 in the expansion of $(2 + x)^4\left(1 + \frac{1}{x^2}\right)$.

4. **(T3.6 - R) (CI)** The angle between the lines DB and BG is θ . **(Cirrito 9.6, p308)**

$$\cos(\theta) = \frac{2}{\sqrt{8 + 2x^2}}$$

- Show that
- If $\theta = 60^\circ$, solve for x .



5. **(C6.2, C6.3 - N) (CI)** For the function $y = \sin(x) + \frac{1}{2} \sin(2x)$ on the domain of $0 \leq x \leq 2\pi$, determine the location and type of the extrema and also the intervals of increase and decrease and then sketch the function. **(Cirrito 20.2, p668)**

6. **(C6.3 - N) (CI)** For the function $p(x) = x^4 + 6x^3 - 24x^2 + 26$, determine: **(Cirrito 20.2, p668)**

- The intervals of increase and decrease
- The coordinates and types for the extrema
- The inflection points
- The intervals of concavity
- Hence, sketch the function.

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Section B (Extended Response/Investigation)

7. **(F2.2, F2.3, C6.1 - R,N) (CI)** Given that $f(x) = 2x - 1$, $g(x) = x^2 - 3$ and $h(x) = \frac{1}{x+3}$, find:
- The derivative of $h \circ g(x)$;
 - $f(h(x))$;
 - $g(h^{-1}(x))$;
 - Show that $f^{-1}(f(x)) = x$
 - Determine the equation of the line that is tangent to $h(x)$ at the point $(3, \frac{1}{6})$
8. **(SP5.2, SP5.3, SP5.6 - R) (CA)** The length of 80 flower stems in Mr Smith's garden are shown in the following cumulative frequency diagram (at the end of the question, on the next page) **(Oxford 8.5, p271)**
- Write down the median length.
 - What percentage of flower stems are 60 cm or greater?
 - At least 18.75% of all flowers have a flower stem length of K . Find the value of K .

The same data is now presented as a frequency table.

Length, x cm	$0 \leq L \leq 30$	$30 < L \leq 60$	$60 < L \leq 90$	$90 < L \leq 120$
Frequency	10	p	20	q

- Find the value of p and q .
- Hence, estimate the mean and standard deviation of the lengths.

Flower stems that are 60 cm or greater in length are considered mature flowers.

- Given that a randomly selected flower is mature, find the probability that its stem length is 85 cm or greater in length.

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