Rate of Change – Revision 2

Zhonghua Secondary School Prelim Exam 2010

1. Given that $y = \ln\frac{1+x}{1-x}$, $x \neq 1$, find

   (i) $\frac{dy}{dx}$

   (ii) the rate of change of x at the instant when $y = \ln 5$, given that y is changing at a rate of 9 units per second at this instant.

$[\frac{2}{1-x^2}; 2.5 \text{ units/s}]$

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2. Find the set of values of x for which $y = x^2 - 3x + 5$ is an increasing function.

$[x > 1\frac{1}{2}]$

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3. Given that $y = (x + 2)e^{2x}$, find the set of values of x for which y is an increasing function.

$[\{x: x > -\frac{5}{2}\}]$

Bukit View Secondary School Prelim Exam 2010

4. Given $y = \frac{4}{\sqrt{2x-3}}$, $x > 1\frac{1}{2}$,

   (i) find $\frac{dy}{dx}$,

   (ii) state whether $y = \frac{4}{\sqrt{2x-3}}$ is an increasing or decreasing function. Explain your answer clearly.

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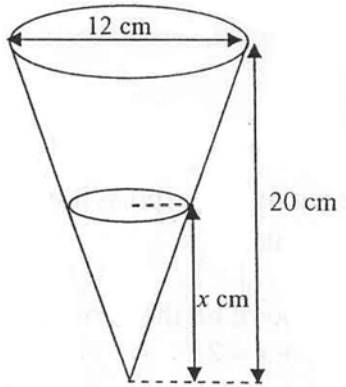
5. The diagram shows an inverted cone of diameter 12 cm and height 20 cm. Water is poured into the cone at a rate of $4 \text{ cm}^3/\text{s}$. Find the rate of change of x when the radius of the water is 2 cm.



$[\frac{1}{\pi} \text{ cm/s}]$

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6. Given that $e^y = 2x^3 - 3$, find $\frac{dy}{dx}$. Hence, given that x is decreasing at the rate of 0.26 units per second, find the rate of change of y when $x = 2$.

$[-0.48 \text{ units/s}]$

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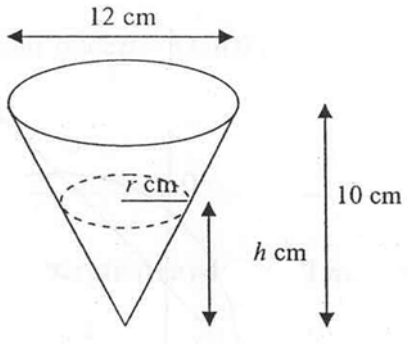
7. The diagram shows a conical flask filled with water to the height h cm and radius of the circular surface as r cm. The height of the cone is 10 cm and the base diameter is 12 cm. The cone is filled with water at a constant rate of $0.2\ \text{cm}^3\text{s}^{-1}$.



(i) Show that the volume, $V = \frac{3}{25}\pi h^3$.

(ii) Find the rate of change for the height of the water level at the instant $h = \frac{1}{3\pi}$ cm.

[15.7cm/s]

Yuying Secondary School Prelim Exam 2010

8. The total surface area of a sphere is increasing at the rate of $48\pi\ \text{cm}^2$ per second at the instant when its radius is 3 cm. Find the rate of increase of the volume of the sphere at the same instant.

[$2\ \text{cm/s}$; $72\pi\ \text{cm}^3/\text{s}$]

Northland Secondary School Prelim Exam 2010

9. A sector of a circle of radius r has an angle of $\frac{\pi}{6}$ radians. Given that r is increasing at a constant rate of $5\ \text{cm s}^{-1}$, calculate, correct to two decimal places, the rate of increase of the area of the sector when $r = 6$ cm.

[15.71]