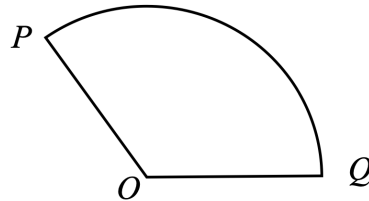# SPM Trial Exam 2022
Johor

Paper 1

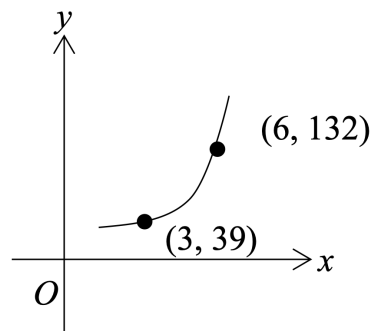1. Diagram 1, shows a sector of a circle with centre O.

The sector is formed from a piece of wire of length 95 cm. It is given that the length of arc PQ is 55 cm, find $\angle$POQ in radians.

Sol.

$$OQ = PQ = \frac{95 - 55}{2} = 20$$
$$20 \cdot \angle POQ = 55$$
$$\angle POQ = \frac{55}{20} = \frac{11}{4} = 2.75 \text{ rad} \qquad\blacksquare$$

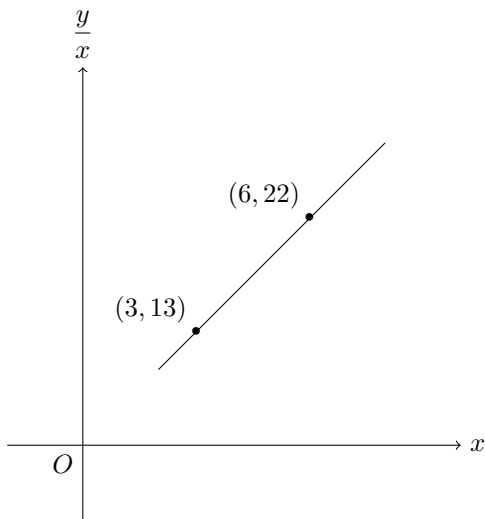2. Diagram 2 shows part of the graph y against x.

It is known that the linear equation that related variables x and y is $\frac{y}{x} = ax + b$, where a and b are constants.

(a) Sketch a straight line graph of the equation $\dfrac{y}{x} = ax + b$.

Sol.

When $x = 6$, $y = 132$, so $\dfrac{y}{x} = 22$.

When $x = 3$, $y = 39$, so $\dfrac{y}{x} = 13$.

(b) Find the value of a and of b.

Sol.

$a = $ Gradient of the line $= \dfrac{22 - 13}{6 - 3} = 3$

$b = $ Intercept of the line $= 13 - 3(3) = 4$

3. (a) Given that $2^y = p$ and $3^y = q$, express $81^{2y} - 4^{2y}$ in terms of p and q.

Sol.

$$81^{2y} - 4^{2y} = (3^4)^{2y} - (2^2)^{2y}$$
$$= 3^{8y} - 2^{4y}$$
$$= (3^y)^8 - (2^y)^4$$
$$= q^8 - p^4$$

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(b) Show that $6^{m+2} + 6^{m+1} - 18(6^m)$ is divisible by 24 by all positive integer values of m.

Sol.

$$6^{m+2} + 6^{m+1} - 18(6^m) = 6^m \cdot 6^2 + 6^m \cdot 6 - 18(6^m)$$
$$= (6^m)(36 + 6 - 18)$$
$$= (6^m)(24) \qquad \blacksquare$$

4. The volume of water, V cm^3, in a container is given by $V = \dfrac{1}{3}h^3 + 8h$, where h cm is the height of water in the container. Water is poured into the container at a rate of 10cm^{3}s^{-1}. Find the rate of change of the height of the water, when its height is 2 cm.

Sol.

$$\frac{dV}{dh} = h^2 + 8$$
$$\frac{dV}{dt} = 10$$
$$\frac{dh}{dt} = \frac{dh}{dV} \cdot \frac{dV}{dt}$$
$$\frac{dh}{dt} \cdot \frac{dV}{dh} = \frac{dV}{dt}$$
$$\frac{dh}{dt} \cdot (h^2 + 8) = 10$$
$$\frac{dh}{dt} = \frac{10}{h^2 + 8}$$

When $h = 2$,

$$\frac{dh}{dt} = \frac{10}{2^2 + 8} = \frac{10}{12} = \frac{5}{6} \text{ cm s}^{-1} \qquad \blacksquare$$