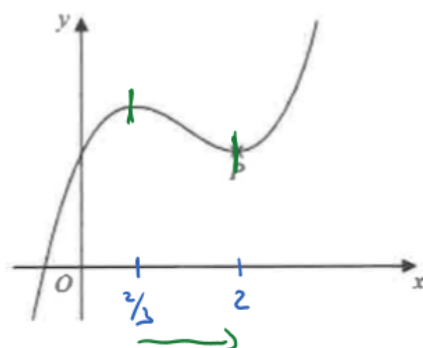# Monster Questions – Set 5

Question 1

$y = x^3 - 4x^2 + 4x + 3$

(a) Find $\dfrac{dy}{dx}$ $= 3x^2 - 8x + 4$

(2)

The diagram shows a sketch of the curve with equation $y = x^3 - 4x^2 + 4x + 3$
The point P is a turning point on the curve.

(b) Work out the coordinates of P.
Show clear algebraic working.

$3x^2 - 8x + 4 = 0$

$(3x - 2)(x - 2) = 0$

$x = \dfrac{2}{3}$ or 2

$x = 2$ $\quad y = x^3 - 4x^2 + 4x + 3$

$\qquad = 8 - 16 + 8 + 3$

$\qquad = 3$

$(\underline{\quad 2 \quad}, \underline{\quad 3 \quad})$

(4)

(c) Write down the range of values of x for which the curve has a negative gradient.

$\dfrac{2}{3} < x < 2$

Question 2

P is directly proportional to q^3
$P = 270$ when $q = 7.5$

(a) Find a formula <mark>for P in terms of q</mark>

$$P = kq^3$$

$$270 = k \times 7.5^3$$

$$k = \frac{270}{7.5^3} = \frac{16}{25} \qquad P = \frac{16}{25} \times q^3$$

(b) Work out the positive value of q when $P = q$

$$P = \frac{16}{25} q^3$$

$$q = \frac{16}{25} q^3$$
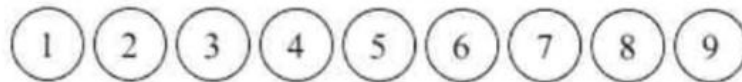
$$1 = \frac{16}{25} q^2$$

$$q^2 = \frac{25}{16}$$

$$q = \sqrt{\frac{25}{16}} = \frac{5}{4}$$

Question 3

Gemma has 9 counters.
Each counter has a number on it.

$$\text{(1)} \; \text{(2)} \; \text{(3)} \; \text{(4)} \; \text{(5)} \; \text{(6)} \; \text{(7)} \; \text{(8)} \; \text{(9)}$$

Gemma puts the 9 counters into a bag.
She takes at random a counter from the bag and does not replace the counter.
She then takes at random a second counter from the bag.

(a) Work out the probability that the number on each counter is an even number.

9   5 odd
     4 even

$$\frac{4}{9} \times \frac{3}{8} = \frac{12}{72}$$

$$= \frac{1}{6}$$

(2)

(b) Work out the probability that the number on the first counter added to the number on the second counter gives an odd number.

o   o   = even   ✗

o   e   = odd   ✓

e   o   = odd   ✓

e   e   = even ✗

$$\frac{5}{9} \times \frac{4}{8} = \frac{20}{72}$$

$$\frac{4}{9} \times \frac{5}{8} = \frac{20}{72}$$

$$\frac{40}{72} = \frac{5}{9}$$
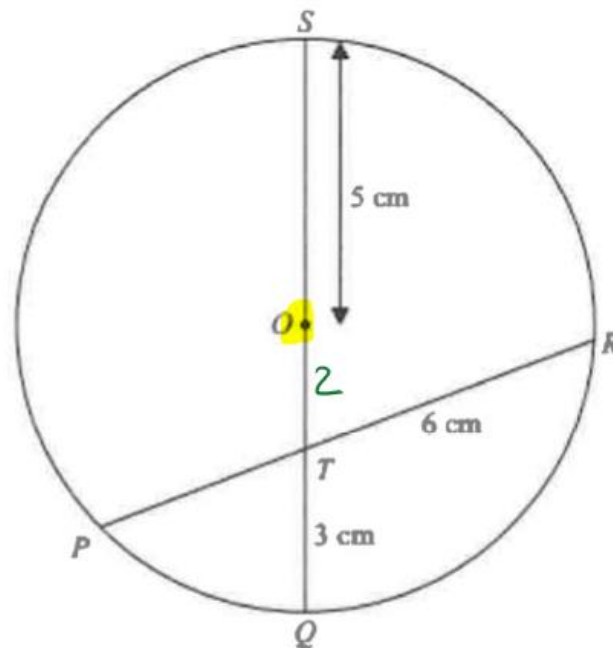
Question 4

Diagram **NOT** accurately drawn

P, Q, R and *S* are points on a circle, centre *O*.
QS is a diameter of the circle.
QS and *PR* intersect at the point *T*.
OS = 5 cm, *QT* = 3 cm and *TR* = 6 cm.

Work out the length of *PT*.

$$PT \times 6 = 3 \times ST$$

$$PT \times 6 = 3 \times 7$$

$$6PT = 21$$

$$PT = 3.5 \text{ cm}$$

Question 5

Here are 7 cards.
Each card has a number on it.

| 1 | 2 | 2 | 3 | 3 | 3 | 4 |

Harry takes at random two cards.

(a) Calculate the probability that the numbers on the two cards are the same.

$2, 2 \longrightarrow \dfrac{2}{7} \times \dfrac{1}{6} = \dfrac{2}{42}$

$3, 3 \searrow \dfrac{3}{7} \times \dfrac{2}{6} = \dfrac{6}{42}$

$\dfrac{8}{42} = \dfrac{4}{21}$

(3)

(b) Calculate the probability that the sum of the numbers on the two cards is 5

$1, 4 \quad \dfrac{1}{7} \times \dfrac{1}{6} = \dfrac{1}{42}$

$4, 1 \quad \dfrac{1}{7} \times \dfrac{1}{6} = \dfrac{1}{42}$

$2, 3 \quad \dfrac{2}{7} \times \dfrac{3}{6} = \dfrac{6}{42}$

$3, 2 \searrow \dfrac{3}{7} \times \dfrac{2}{7} = \dfrac{6}{42}$

$\dfrac{14}{42} = \dfrac{1}{3}$