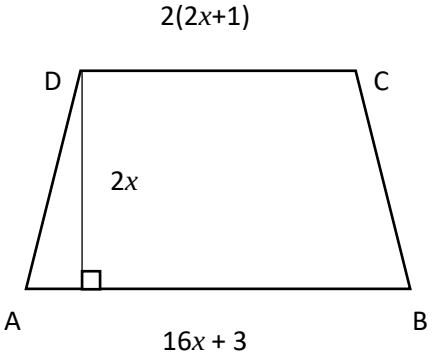
DOKA Paper U (for Year Level 11-13)

Sample Questions

(Part A - Basic Reasoning)

Given ABCD is a trapezium and AB is parallel to CD. AB = $(16x + 3)$ cm, CD = $2(2x+1)$ cm and the height of the trapezium, which is DE = $2x$ cm. If the area of the trapezium is 90 cm^2, what is the value of x in cm?

Solution:



$\frac{1}{2}(2x)(16x + 3 + 4x + 2) = 90$

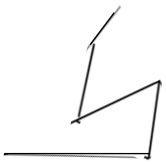
$x(20x + 5) = 90$

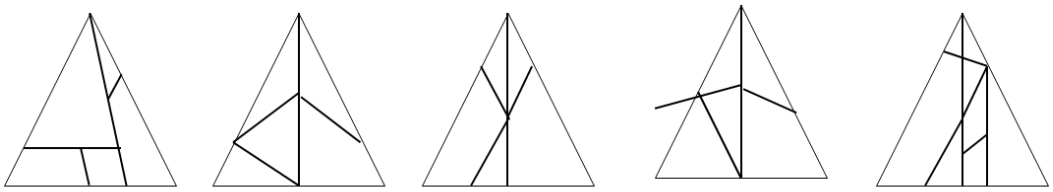
$20x^2 + 5x - 90 = 0$

$(4x + 9)(5x - 10) = 0$

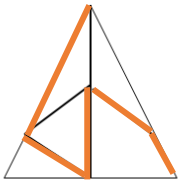
$x = -\frac{9}{4}$ (rejected), $x = \frac{10}{5} = \mathbf{2}$

(Part B - Intermediate Reasoning: NVR)

The pattern shown here  can be seen in…



A B C D E



Solution: Option **B**

(Part C - Advanced Reasoning)

Two mechanical toys, P and Q which move at uniform speeds are 30 metres apart on a straight path initially. When P moves towards Q and Q moves away from P, with P moving 4 minutes earlier, the two toys meet each other after P has moved for 16 minutes. If P and Q move towards each other, with P moving 4 minutes earlier, the two toys will meet after P has moved for 8 minutes. What is the value of $\frac{\text{speed P}}{speed\ Q}$?

Solution:

Let speed of P and Q be a cm/sec and b cm/sec respectively.

Let scenario 1 = P moves towards Q, Q moves away from P

16 x 60a – (16 – 4) x 60b = 3000

960a – 720b = 3000

8a – 6b = 25 ---------(1)

:Let scenario 2 = P and Q move towards each other

8 x 60a + (8 – 4) x 60b = 3000

480a + 240b = 3000

4a + 2b = 25 ----------(2)

By solving simultaneously, P = 5 cm/s and Q = 2.5 cm/s

$\frac{\text{P}}{\text{Q}} = \frac{5}{2.5} =$ **2**

(Part D - Extended Reasoning)

Given $2p^2 + 8q^2 + 32r^2 = 96$ and $2pq + 8qr + 4pr = 48$, what is the value of $p^2 + q^2 + r^2$ if p, q and r are real numbers ?

Solution:

$2p^2 + 8q^2 + 32r^2 = 96$

$P^2 + 4q^2 + 16r^2 = 48$

$(p)^2 + (2q)^2 + (4r)^2 = 48$ -------（1）

$2pq + 8qr + 4pr = 48$ ------- (2)

(1) – (2), we get

$p^2 + (2q)^2 + (4r)^2 – 2pq – 8qr – 4pr = 0$

$2p^2 + 2(2q)^2 + 2(4r)^2 – 2(2pq) – 2(8qr) – 2(4pr) = 2 \times 0 = 0$

$p^2 + p^2 + (2q)^2 + (2q)^2 + (4r)^2 + (4r)^2 – 4pq – 16qr – 8pr = 0$

$[p^2 + (2q)^2 – 4pq] + [(2q)^2 + (4r)^2 – 16qr] + [p^2 + (4r)^2 – 8pr] = 0$

$[(p – 2q)^2 + (2q – 4r)^2 + (p – 4r)^2] = 0$

$p – 2q = 0, 2q – 4r = 0, p – 4r = 0$

$p = 2q = 4r \Longrightarrow$ Take α to replace r

Therefore (p , q , r) = (4α , 2α, α)

$2p^2 + 8q^2 + 32r^2 = 96$

$32\alpha^2 + 32\alpha^2 + 32\alpha^2 = 96$

$96\alpha^2 = 96$

$\therefore \alpha^2 = 1$

$p^2 + q^2 + r^2 = 16\alpha^2 + 4\alpha^2 + \alpha^2$

$= 21\ \alpha^2$

$= 21\ (1) =$ **21**