

# 2016 NS Paper 1

$$\textcircled{1} \frac{1}{2} \underline{p} + \underline{q} = \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix}$$
$$= \underline{\underline{\begin{pmatrix} -3 \\ -4 \end{pmatrix}}}$$

$$\textcircled{2} \frac{3}{4} \left( \frac{1}{3} + \frac{2}{7} \right) = \frac{3}{4} \times \left( \frac{7}{21} + \frac{6}{21} \right)$$
$$= \frac{3}{4} \times \frac{13}{21}$$
$$= \underline{\underline{\frac{13}{28}}}$$

$$\textcircled{3} \text{Area} = \frac{45}{360} \pi (20)^2$$
$$= \frac{1}{8} \pi \times 400$$
$$= \pi \times 50$$
$$= 3.14 \times 50$$
$$= 31.4 \times 5$$
$$= \underline{\underline{157 \text{ cm}^2}}$$

$$\textcircled{4} \begin{array}{l} 2C + 3D = 9.6 \quad \textcircled{1} \\ 3C + 4D = 13.3 \quad \textcircled{2} \end{array}$$

$$\textcircled{1} \times 4 \quad 8C + 12D = 38.4 \quad \textcircled{3}$$

$$\textcircled{2} \times 3 \quad 9C + 12D = 39.9 \quad \textcircled{4}$$

$$\textcircled{1} - \textcircled{3} \quad C = 1.5$$

$$2(1.5) + 3D = 9.6$$

$$3D = 9.6 - 3$$

$$3D = 6.6$$

$$D = 2.2$$

$$1 \text{ cloak} = 1.5 \text{ m}^2$$

$$1 \text{ dress} = 2.2 \text{ m}^2$$

$$\textcircled{5} D(3, 100) \in (15, 360)$$

$$m = \frac{360 - 100}{15 - 3} \quad y - b = m(x - a)$$

$$= \frac{260}{12}$$

$$y - 100 = 20(x - 3)$$

$$y + 100 = 20x - 60$$

$$= \underline{\underline{20}}$$

$$y = 20x + 40$$

$$\therefore \underline{\underline{W = 20A + 40}}$$

$$\text{b) } 1 \text{ year} = 12 \text{ months}$$

$$\therefore W = 20 \times 12 + 40$$

$$= \underline{\underline{280 \text{ kg}}}$$

$$\textcircled{6} \begin{array}{l} a = 7 \\ b = 5 \\ c = -1 \end{array} \quad \begin{array}{l} b^2 - 4ac \\ = 5^2 - 4(7)(-1) \\ = 25 - (-28) \\ = \underline{\underline{53}} \end{array}$$

$b^2 - 4ac > 0$ ,  $\therefore$  roots are real and unequal.

$$\textcircled{7} \text{a) } B = (8, 0, 0)$$

(square base is 6 units)

$$\text{b) } \vec{AV} = \underline{v} - \underline{a}$$
$$= \begin{pmatrix} 5 \\ 2 \\ 6 \end{pmatrix} - \begin{pmatrix} 2 \\ 0 \\ 6 \end{pmatrix}$$

$$= \underline{\underline{\begin{pmatrix} 3 \\ 2 \\ 6 \end{pmatrix}}}$$

$$|\vec{AV}| = \sqrt{3^2 + 2^2 + 6^2}$$

$$= \sqrt{9 + 4 + 36}$$

$$= \sqrt{49}$$

$$= \underline{\underline{7 \text{ units}}}$$



$$\textcircled{8} \quad \frac{2x}{3} - \frac{5}{6} = 2x$$

$$\frac{4x}{6} - \frac{5}{6} = 2x$$

$$\frac{4x-5}{6} = 2x$$

$$4x-5 = 12x$$

$$-8x = 5$$

$$\underline{\underline{x = -\frac{5}{8}}}$$

$$\textcircled{9} \quad f(s) = \frac{2}{\sqrt{s}} \times \frac{\sqrt{s}}{\sqrt{s}}$$

$$= \frac{2\sqrt{s}}{s}$$

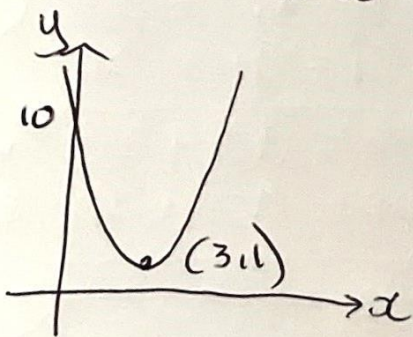
$$\textcircled{10} \quad y = (x-3)^2 + 1$$

→ MIN TP @ (3, 1)

y-axis  $y = (0-3)^2 + 1$

$$= 9 + 1$$

$$= 10 \quad (0, 10)$$



$$\textcircled{1} \quad \tan^2 x \cos^2 x = \left( \frac{\sin^2 x}{\cos^2 x} \right) \cos^2 x$$

$$= \underline{\underline{\sin^2 x}}$$

$$\textcircled{12} \quad \text{a) } A = (2x+1)(x+8)$$

$$\text{b) Triangle} = \frac{1}{2}(3x)2(x+5)$$

$$= (3x)(x+5)$$

$$= \underline{\underline{3x^2 + 15x}}$$

$$(2x+1)(x+8) = \underline{\underline{2x^2 + 17x + 8}}$$

	$x$	$+8$
$2x$	$2x^2$	$+16x$
$+1$	$+x$	$+8$

$$\therefore 2x^2 + 17x + 8 = 3x^2 + 15x$$

$$0 = x^2 - 2x - 8$$

$$x^2 - 2x - 8 = 0 \quad (\text{as required})$$

	$x$	$-4$	
$x$	$x^2$	$-4x$	$\frac{8}{1 \quad 8}$
$+2$	$+2x$	$-8$	$\underline{\underline{2 \quad 4}}$

$$\therefore (x-4)(x+2) = 0$$

$$\underline{\underline{x=4}} \quad \cancel{x=-2}$$

( $x$  can't be negative)

$$\therefore \text{length} = x+8$$

$$= \underline{\underline{12 \text{ cm}}}$$

$$\text{breadth} = 2x+1$$

$$= \underline{\underline{9 \text{ cm}}}$$



## Paper 2

$$\textcircled{1} -8\% \rightarrow 92\% \\ = 0.92$$

$$35 \times 0.92^3 \\ = \underline{\underline{27.3g}}$$

$$\textcircled{2} 12 \div 1.5 \times 10^9 \\ = \underline{\underline{8 \times 10^{-9}g}}$$

$$\textcircled{3} \vec{BD} = \vec{BA} + \vec{AD} \\ = \underline{\underline{-u + v}}$$

$$\textcircled{4} 3x^2 - 48 = 3(x^2 - 16) \\ = \underline{\underline{3(x-4)(x+4)}}$$

$$\textcircled{5} \angle EOA = 180 - 143 \\ = 37^\circ$$

$$\angle EOA = \angle OAC$$

$$\therefore \angle OAC = 37^\circ$$

$$\angle CAB = 90 - 37 \\ = \underline{\underline{53^\circ}}$$

Triangle ABC is isosceles

$$\therefore \angle CBA = 180 - 2 \times 53 \\ = \underline{\underline{74^\circ}}$$

$$\textcircled{6} a)$$

$x$	$x - \bar{x}$	$(x - \bar{x})^2$
13	0	0
16	3	9
10	-3	9
22	9	81
5	-8	64
12	-1	1
78	0	164

$$\bar{x} = \frac{78}{6} \\ = \underline{\underline{13}}$$

$$s = \sqrt{\frac{164}{5}} \\ = \underline{\underline{5.7}}$$

b) On average, Sophie waited longer as  $15 > 13$ . Her waiting times were more consistent as  $4.3 < 5.7$ .

$$\textcircled{7} \text{Volume} = V_{\text{large}} - V_{\text{small}} \\ = \frac{1}{3}\pi(16)^2(20) - \frac{1}{3}\pi(9)^2(13.5) \\ = 6633.98... - 1145.11... \\ = 5288.86... \\ = \underline{\underline{5300 \text{ cm}^3}} \text{ (2 sf)}$$

$$\textcircled{8} \frac{\sin x}{150} = \frac{\sin 66}{140}$$

$$\sin x = \frac{150 \sin 66}{140}$$

$$x = \sin^{-1}\left(\frac{150 \sin 66}{140}\right)$$

$$= \underline{\underline{78.2^\circ}}$$

$$\textcircled{9} x^2 + 8x - 7 = (x+4)^2 - 7 - 16 \\ = \underline{\underline{(x+4)^2 - 23}}$$

$$\textcircled{10} (n^2)^3 \times n^{-10} = n^6 \times n^{-10} \\ = n^{-4} \\ = \underline{\underline{\frac{1}{n^4}}}$$



$$\textcircled{11} \quad SF = \frac{60}{100}$$

$$= \frac{3}{5}$$

$$\text{Cost} = \left(\frac{3}{5}\right)^2 \times 13.75$$

$$= \underline{\underline{\pounds 4.95}}$$

$$\textcircled{12} \quad \sqrt{4kt - p} = L$$

$$4kt - p = L^2$$

$$4kt = L^2 + p$$

$$k = \frac{L^2 + p}{4t}$$

$$\textcircled{13} \quad \frac{3}{x-2} + \frac{5}{x+1}$$

$$= \frac{3(x+1) + 5(x-2)}{(x-2)(x+1)}$$

$$= \frac{3x + 3 + 5x - 10}{(x-2)(x+1)}$$

$$= \frac{8x - 7}{(x-2)(x+1)}$$

$$\textcircled{14} \quad 2 \tan x + 5 = -4$$

$$2 \tan x = -9$$

$$\tan x = -4.5$$

$$x = \tan^{-1}(4.5)$$

$$x = 77.5^\circ$$

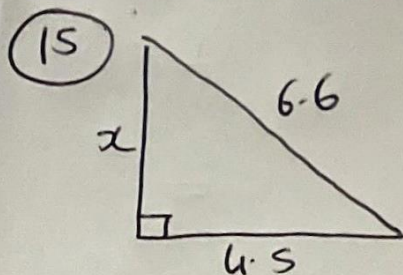
$$x = \underline{\underline{102.5^\circ, 282.5^\circ}}$$

80 - 77.5

~~S~~ ~~A~~

~~X~~ ~~C~~

360 - 77.5



$$x^2 = 6.6^2 - 4.5^2$$

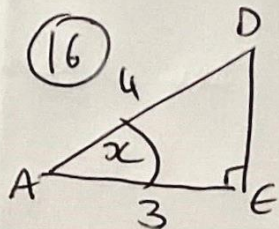
$$= 23.31$$

$$x = \sqrt{23.31}$$

$$= 4.8$$

$$\text{Height} = 4.8 + 6.6$$

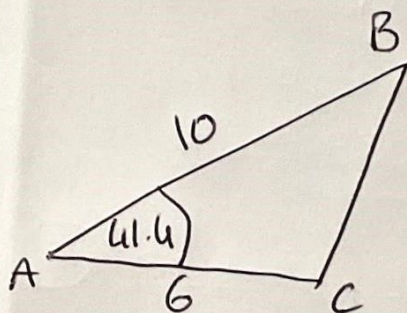
$$= \underline{\underline{11.4 \text{ cm}}}$$



$$\cos x = \frac{3}{4}$$

$$x = \cos^{-1}\left(\frac{3}{4}\right)$$

$$x = 41.4^\circ$$



$$a^2 = 6^2 + 10^2 - 2(6)(10)\cos 41.4$$

$$= 46$$

$$a = \sqrt{46}$$

$$= 6.782 \dots$$

$$= \underline{\underline{6.8 \text{ cm (1 dp)}}}$$