MATHS HUNTER

National 5

Exam Solutions

2016 SQA Exam

Paper 1

1. $\frac{1}{2}\begin{pmatrix}4\\-6\end{pmatrix}+\begin{pmatrix}5\\-1\end{pmatrix}$

$\begin{pmatrix}2\\-3\end{pmatrix}+\begin{pmatrix}5\\-1\end{pmatrix}$

$\begin{pmatrix}7\\-4\end{pmatrix}$

2. $\frac{3}{4}\left(\frac{1\times7}{3\times7}+\frac{2\times3}{7\times3}\right)$ *Fractions need same denominator*

$\frac{3}{4}\left(\frac{7}{21}+\frac{6}{21}\right)$

$\frac{3}{4}\times\frac{13}{21}$ *3 and 21 can be cross simplified*

$\frac{1}{4}\times\frac{13}{7}$ = $\frac{13}{28}$

3. $\frac{45}{360}\times\pi r^2$

$\frac{45}{360}\times3{\cdot}14\times20^2$ *fraction can be simplified*

$\frac{1}{8}\times3{\cdot}14\times400$ *400 ÷ 8 =*

$3{\cdot}14\times50$ *3·14 × 10 × 5*

$157cm^2$

4. **a)** $2c + 3d = 9{\cdot}6$

b) $3c + 4d = 13{\cdot}3$

c)

$2c + 3d = 9{\cdot}6$ ① × 3
$3c + 4d = 13{\cdot}3$ ② × 2

$6c + 9d = 28{\cdot}8$ ③
$6c + 8d = 26{\cdot}6$ ④

③ – ④

$d = 2{\cdot}2$

Sub $d = 2{\cdot}2$ into ①

$2c + 3 \times 2{\cdot}2 = 9{\cdot}6$

$2c + 6{\cdot}6 = 9{\cdot}6$

$2c = 3$
$c = 1{\cdot}5$

Dress = $2{\cdot}2m^2$
Cloak = $1{\cdot}5m^2$

5. **a)**

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{340 - 100}{15 - 3} = \frac{240}{12} = 20$$

$y - b = m(x - a)$ $\quad$ $(a, b) = (3, 100)$

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

$y - 100 = 20x - 60$

$y = 20x + 40$

$W = 20A + 40$

b) $W = 20 \times 12 + 40 = 280\text{kg}$

6. $a = 7$, $\quad b = 5$ $\quad$ and $c = -1$

$b^2 - 4ac = 5^2 - 4 \times 7 \times (-1)$

$= 25 - (-28) = 53$

$b^2 - 4ac > 0$

There are 2 real and distinct roots

7. a) B (8, 4, 0)

b) $\overrightarrow{AV} = v - a = \begin{pmatrix} 5-2 \\ 2-0 \\ 6-0 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 6 \end{pmatrix}$

$\left|\overrightarrow{AV}\right| = \sqrt{3^2 + 2^2 + 6^2}$

$\left|\overrightarrow{AV}\right| = \sqrt{9 + 4 + 36}$

$\left|\overrightarrow{AV}\right| = \sqrt{49}$ = 7 units

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

$\frac{2x}{3} \times 6 - \frac{5}{6} \times 6 = 2x \times 6$ *Multiply by 6*

$\frac{12x}{3} - \frac{30}{6} = 12x$

$4x - 5 = 12x$

$8x = -5$

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

9. $f(5) = \frac{2}{\sqrt{5}}$

$= \frac{2 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}}$

$= \frac{2\sqrt{5}}{5}$

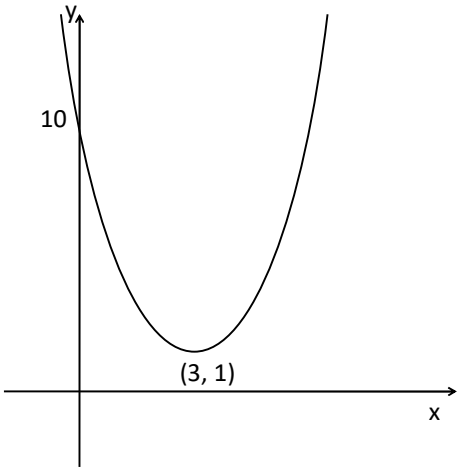
10. y intercept at $x = 0$

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

$y = 10$

Turning point = (3, 1) *make bracket = 0*

x^2 is positive => minimum TP



11. $\tan^2 x = \frac{\sin^2 x}{\cos^2 x}$

=> $\tan^2 x \cos^2 x = \frac{\sin^2 x}{\cos^2 x} \cos^2 x$

$= \sin^2 x$

12. a) Area of rectangle = L × B

$A_1 = (2x + 1)(x + 8)$

$A_1 = 2x^2 + 16x + x + 8$

$A_1 = 2x^2 + 17x + 8$

b) Area of triangle = ½ B × H

$A_2 = ½\ 2(x + 5) \times 3x$

$A_2 = (x + 5) \times 3x = 3x(x + 5)$

$A_2 = 3x^2 + 15x$

$A_1 = A_2$

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

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

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

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

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

$x = 4$ or $x = -2$

$X \neq -2$ (this would make lengths $3x$ and $2x - 1$ negatives which is impossible)

$\Rightarrow x = 4$

$L = x + 8 = 12cm$
$B = 2x + 1 = 9cm$

Paper 2

1. 100% – 8% = 92%

$35 \times 0{\cdot}92^3 =$

27·25408g

2. $12 \div (1{\cdot}5 \times 10^9)$

8×10^{-9}

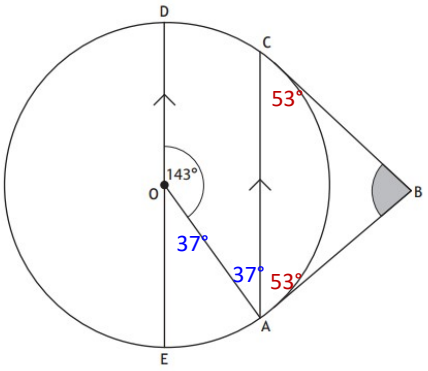
3. **v – u**

4. $3(x^2 – 16)$

$3(x – 4)(x + 4)$

5. 180 – 143 = 37

90° – 37° = 53°



ABC = 180 – 53 – 53

ABC = 74°

6. a) $\bar{x} = \frac{13+16+10+22+5+12}{6} = 13$

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

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

$$s = \sqrt{\frac{164}{5}} = 5{\cdot}727$$

b) Sophies mean was higher
=> **on average** her call wait times was higher.

Sophies standard deviation was less.
=> her call wait times were more **consistent.**

7. $V_{\text{Small cone}} = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi \times 9^2 \times 13{\cdot}5$

$= 1145.11052223\ \text{cm}^3$

$V_{\text{large cone}} = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi \times 16^2 \times 24$

$= 6433.98175455\ \text{cm}^3$

$V_{\text{carton}} = 5288.87123232\ \text{cm}^3$

$= 5300\ \text{cm}^3$

8. $$\frac{\sin x^\circ}{150} = \frac{\sin 66^\circ}{140}$$

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

$\sin x° = 0.97879870461$

$x° = 78.1807714952°$

9. $(x + 4)^2 + \_\_\_$

$x^2 + 8x + 16 + \_\_\_$

$x^2 + 8x + 16 - 23$

$(x + 4)^2 - 23$

10. $n^6 \times n^{-10}$

n^{-4}

$\frac{1}{n^4}$

11. Scale Factor = $\frac{100}{60} = \frac{5}{3} = 1{\cdot}6...$

Area S. F = $\left(\frac{5}{3}\right)^2 = \frac{25}{9} = 2{\cdot}7...$

Cost of small = $13{\cdot}75 \div 2{\cdot}7...$

= £4·95

12.

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

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

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

13.

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

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

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

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

14. $2\tan x° = -9$

$$\tan x° = \frac{-9}{2} = -4{\cdot}5$$

Tan x° is negative in Q2 & Q4

In Q1

$x° = \tan^{-1}(4{\cdot}5)$

$x° = 77.4711922908$ (use 77·5°)

In Q2

$x° = 180 - 77{\cdot}5 = 102{\cdot}5°$

In Q4

$x° = 360 - 77{\cdot}5 = 282{\cdot}5°$

15. $x^2 = 6{\cdot}6^2 - 4{\cdot}5^2$

$x^2 = 23.31$

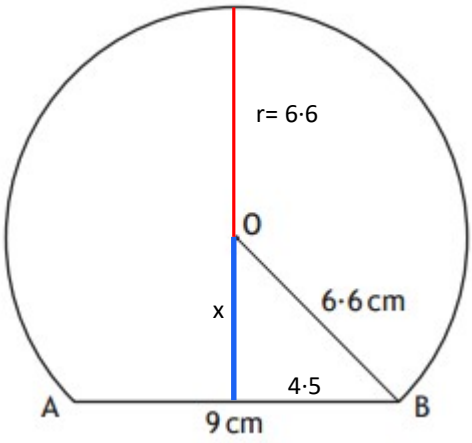
$x = \sqrt{23{\cdot}31}$

$x = 4{\cdot}828043$ cm (use 4·8)

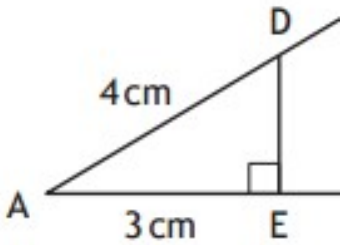
$h = x + r$

$h = 4{\cdot}8 + 6{\cdot}6$

$h = 11{\cdot}4$cm



16. Use SOHCAHTOA on ADE

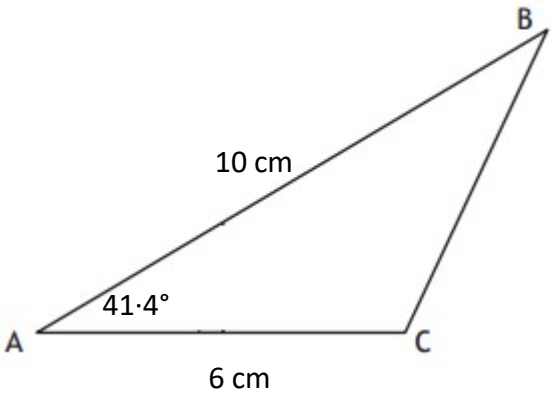


$\cos A° = \frac{A}{H}$

$\cos A° = \frac{3}{4} = 0{\cdot}75$

$A° = \cos^{-1}(0{\cdot}75) = 41.4096221093$

(use 41·4°)



$a^2 = b^2 + c^2 - 2bc \cos A$

$a^2 = 6^2 + 10^2 - 2\times6\times10 \cos 41{\cdot}4$

$a^2 = 45.9866716443$

$a = 6.78134733253 = 6{\cdot}8$ cm