MATHS HUNTER

National 5

Exam Solutions

SQA Exam 2018 Solutions

Paper 1

1. $\frac{7}{3}+\frac{4}{5}$

$\frac{7\times5}{3\times5}+\frac{4\times3}{5\times3}$

$\frac{35}{15}+\frac{12}{15}$ = $\frac{47}{15}=3\frac{2}{15}$

2 $(3x+1)(x-1)+2(x^2-5)$

$3x^2 - 3x$

$+x - 1$

$2x^2 - 10$

$5x^2 - 2x - 11$

3

$4x + 5y = -3$ ① × 2

$6x - 2y = 5$ ② × 5

$8x + 10y = -6$ ③

$30x - 10y = 25$ ④

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③ + ④

$38x = 19$

$x = 0{\cdot}5$

Sub x = 0·5 into ①

$4x + 5y = -3$

$2 + 5y = -3$

$5y = -5$

$y = -1$

4 $\begin{pmatrix}1\\5\\1\end{pmatrix} + \begin{pmatrix}\_\\\_\\\_\end{pmatrix} = \begin{pmatrix}6\\-4\\3\end{pmatrix}$

$\mathbf{v} = \begin{pmatrix}5\\-9\\2\end{pmatrix}$

5 $x^2 - 11x + 24 = 0$

$(x - 3)(x - 8) = 0$

$x - 3 = 0$ or $x - 8 = 0$

$x = 3$ or $x = 8$

6 Graph max=5, min = –5 => a = 5

2 waves between 0 and 180 means 4 waves between 0 and 360
=> b = 4

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

$m = \frac{20 - 14}{12 - 8}$

$m = \frac{6}{4} = \frac{3}{2}$

$y = mx + c$ sub in (8, 14)

$14 = \frac{3}{2} \times 8 + c$

$14 = 12 + c$

$C = 2$

$y = \frac{3}{2}x + 2$

$P = \frac{3}{2}d + 2$

7 **b** $\frac{3}{2} \times 5 + 2$

$7{\cdot}5 + 2 = £9{\cdot}50$

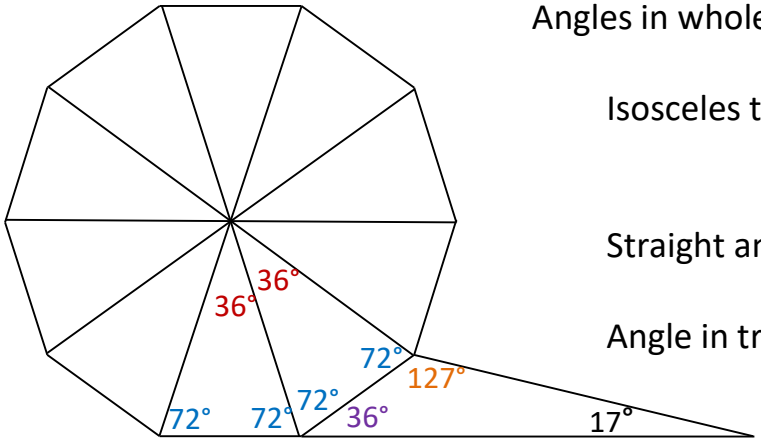
8 $a = 2, \quad b = 4, \quad c = 5$

$b^2 - 4ac$

$4^2 - 4 \times 2 \times 5$
$16 - 40 = 24$

$b^2 - 4ac < 0$
No real roots

9



Angles in whole turn	$360 \div 10 = 36$
Isosceles triangles	$180 - 36 = 144$ $144 \div 2 = 72$
Straight angle	$180 - 72 - 72 = 36$
Angle in triangle	$180 - 127 - 36 = 17°$

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

$a^2 = 10^2 + 8^2 - 2 \times 8 \times 10 \times 1/8$

$a^2 = \quad 164 - 2 \times 8 \times 10 \times 1/8$

$a^2 = 164 - 20 = 144$

$a = \sqrt{144}$

$a = 12$

11 $\frac{9 \times \sqrt{6}}{\sqrt{6} \times \sqrt{6}}$

$\frac{9\sqrt{6}}{6} = \frac{3\sqrt{6}}{2}$

12 cos 60° = 0·5

Cos is positive in Q1 and Q4

240 is in Q3 (between 180 and 270)

Therefore cos 240° = – 0·5

13 Use D (6, 0 , 0) (A is 4 along x, so D must be 6)

B(4, 8, 5)
C(6, 8, 0)

14 $y - h = g\sqrt{x}$ (swap sides)

$\sqrt{x} = \frac{y-h}{g}$

$x = \left(\frac{y-h}{g}\right)^2$

15

$\left(\frac{2}{3}\right)^2 = \frac{4}{9}$

$\left(p^4\right)^2 = p^8$

$\frac{4}{9}p^8$

16

When x = 0 (y intercept)

y = –6 × 4 = – 24 (0, 24)

When y = 0 (roots)

0 = (x – 6)(x + 4)
x= 6, x = –4

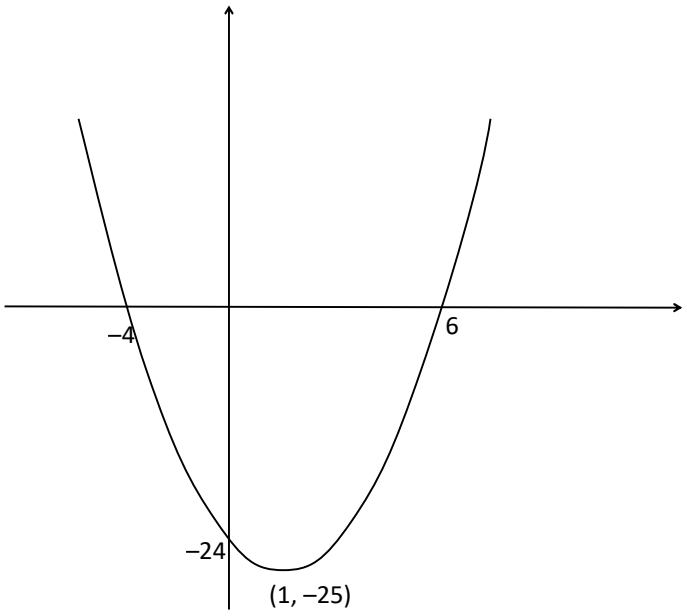
(–4, 0)
(6, 0)

Turning point: x value will be in between roots

–4 –3 –2 –1 0 **1** 2 3 4 5 6

x = 1

y = (1 – 6)(1 + 4)
= – 5 × 5 = –25 (1, –25)



17

V = ⅓ Ah

⅓ 6 × 6 × h = 138

12h = 138

$h = \frac{138}{12} = \frac{69}{6} = \frac{23}{2}$

h = 11·5cm

18 $\tan x = \frac{\sin x}{\cos x}$

$\sin x \cos x \frac{\sin x}{\cos x}$

$\sin^2 x$

19 ai $(x - 3)^2 + q$

$x^2 - 6x + 9 + q$ $\quad 9 + q = -81$

$(x - 3)^2 - 90$

p = 3

q = –90

ii x = 3 (this would make the bracket (3 – 3) = 0

b **Method 1**

$(x-3)^2 - 90 = 0$

$(x-3)^2 = 90$

$x - 3 = \pm\sqrt{90}$

$x = 3 \pm \sqrt{90}$

$x = 3 \pm \sqrt{9}\sqrt{10}$

$x = 3 \pm 3\sqrt{10}$

Method 2 (probably used more)

$a = 1, \quad b = -6 \quad c = -81$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{6 \pm \sqrt{(-6)^2 - 4 \times 1 \times -81}}{2}$$

$$\frac{6 \pm \sqrt{36 + 324}}{2}$$

$$\frac{6 \pm \sqrt{360}}{2}$$

$$\frac{6 \pm \sqrt{36}\sqrt{10}}{2}$$

$$\frac{6 \pm 6\sqrt{10}}{2}$$

$$3 \pm 3\sqrt{10}$$

Paper 2

1. Fall by 2% = 100 – 2 = 98%

2018, 2019, 2020 = 3 years

$125\,000 \times 0{\cdot}98^3$

117 649 tonnes

2 r = 7·4

d = 14·8

$\frac{320}{360} \times \pi \times 14{\cdot}8$

41·32939 cm (41·308444 cm)

3

$|r| = \sqrt{24^2 + (-12)^2 + 8^2}$

$|r| = \sqrt{789}$

$|r| = 28$

4 $3x < 6x - 6 - 12$

$3x < 6x - 18$

$18 < 3x$

$6 < x$

$x > 6$

5

$\bar{x} = \frac{756}{6} = 126$

x	$\bar{x}$	$x - \bar{x}$	$(x - \bar{x})^2$
120	126	–6	36
126	126	0	0
125	126	–1	1
124	126	–2	4
130	126	4	16
131	126	5	25
			82

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

$s = \sqrt{\frac{82}{5}}$

$s = \sqrt{16 \cdot 4}$

$s = 4 \cdot 04969$

b

Mean has reduced => On average less people visited on Sunday

S.D has increased => Amount of visitors to different stalls less consistent on Sunday
(or visitors to stalls on Sunday more spread)

6 f(a) = 5 + 4a = 73

4a = 68

a = 17

7 $V = 4/3\ \pi\ r^3$

$V = 4 \div 3 \times \pi \times 3{\cdot}2^3$

$V = 137{\cdot}258$ (137·18869)

$V = 140cm^3$

8

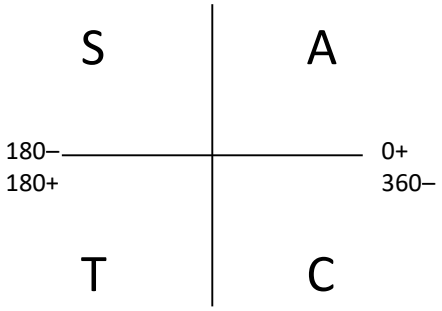
$7 \sin x + 2 = 3$

$7 \sin x = 1$

$\sin x = 1/7$

Base angle $x = \sin^{-1}(1/7)$

$x = 8{\cdot}2°$



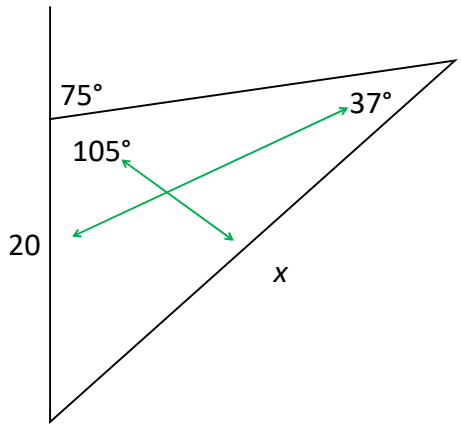
sin *x* is positive (1/7 is positive)

Sin *x* is positive in Q1 and Q2

In Q1 $x = 8{\cdot}2°$

In Q2 $x = 180 – 8{\cdot}2 = 171{\cdot}8°$

9



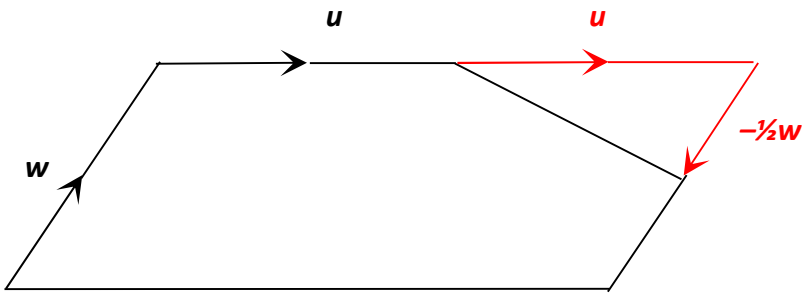
180 – 75 = 105

$$\frac{x}{\sin 105} = \frac{20}{\sin 37}$$

$$x = \frac{20\sin 105}{\sin 37}$$

$$x = 32{\cdot}1 \text{ cm}$$

10



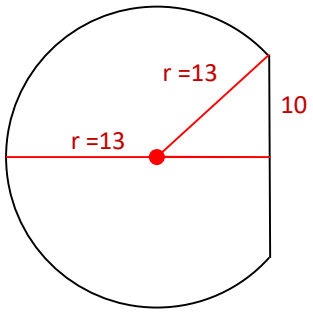
BC = u – ½w

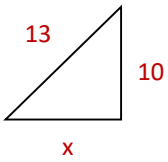
11 85% = $9{\cdot}3 \times 10^{11}$

100% = $(9{\cdot}3 \times 10^{11}) \div 0{\cdot}85$

= $1{\cdot}094117647 \times 10^{12}$ km^3

12





$x^2 = 13^2 - 10^2$

$x^2 = 69$

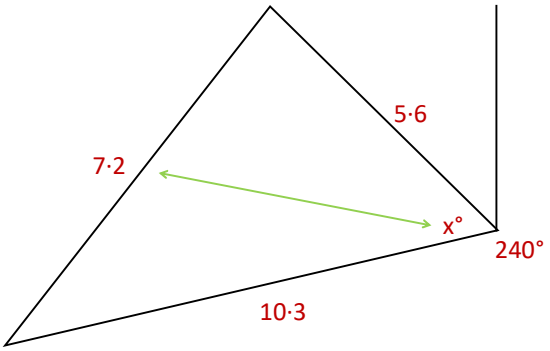
$x = \sqrt{69}$

$x = 8{\cdot}3066$ cm (use 8·3)

Width = 13 + 8·3

= 21·3cm

13



$$\cos x = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos x = \frac{10{\cdot}3^2 + 5{\cdot}6^2 - 7{\cdot}2^2}{2 \times 10{\cdot}3 \times 5{\cdot}6}$$

$$\cos x = \frac{85{\cdot}61}{115{\cdot}36}$$

$$\cos x = 0{\cdot}75$$

$$x = 42{\cdot}088$$
$$= 42{\cdot}1°$$

$$\text{Bearing} = 240 + 42{\cdot}1$$
$$= 282{\cdot}1°$$

14 On y axis x =0

$2x - 5y = 20$

$-5y = 20$

$y = -4$ $\quad (0, -4)$

15

$$\frac{n}{n^2-4} \div \frac{3}{n-2}$$

$$\frac{n}{n^2-4} \times \frac{n-2}{3}$$

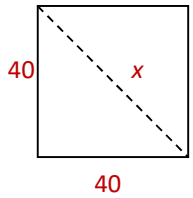
$$\frac{n(n-2)}{3(n^2-4)}$$

$$\frac{n(n-2)}{3(n-2)(n+2)}$$

$$\frac{n}{3(n+2)}$$

16. Method 1Repeated Pythagoras

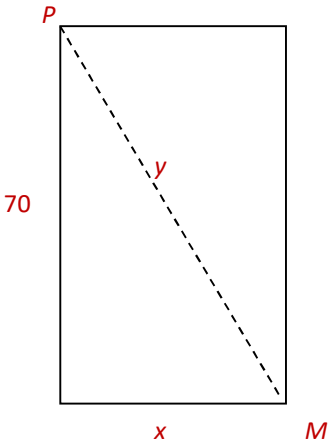
Base of cuboid



$x^2 = 40^2 + 40^2$

$x^2 = 3200$

Cross Section of Cuboid



$y^2 = x^2 + 70^2$

$y^2 = 3200 + 4900$

$y^2 = 8100$

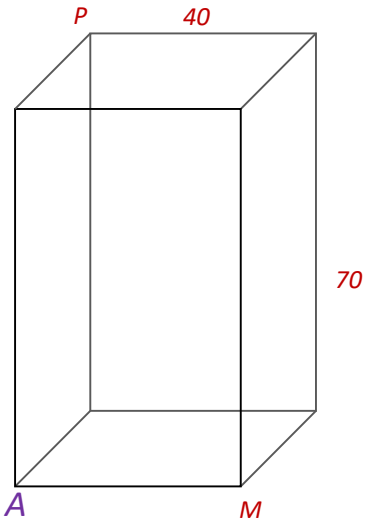
$y = 90$ cm

PM is the largest space for a straight object to go.

PM = 90cm which is larger than 85 cm so

The umbrella will fit

16. Method 2 3D Coordinates/ Vector Magnitude



Assume point A (0, 0, 0)

Therefore M(40, 0, 0)

P(0, 40, 70)

$$\overrightarrow{MP} = \begin{pmatrix} 70-0 \\ 40-0 \\ 0-40 \end{pmatrix} = \begin{pmatrix} 70 \\ 40 \\ -40 \end{pmatrix}$$

$$\left|\overrightarrow{MP}\right| = \sqrt{70^2 + 40^2 + (-40)^2}$$

$$\left|\overrightarrow{MP}\right| = \sqrt{8100}$$

$$\left|\overrightarrow{MP}\right| = 90$$

PM is the largest space for a straight object to go.

PM = 90cm which is larger than 85 cm so

The umbrella will fit

17.

Area of triangle = ½ ab sinC

= ½ 38 × 55 × sin75

= 1009·392488

Area of sector = $\frac{75}{360} \times \pi r^2$

= $\frac{75}{360} \times \pi \times 30^2$

= 589·0486225 (588·75)

Shaded Area = Sector – Triangle

= 420·3438655 cm^2 (420·642488)

18 a

Scale Factor (Length) = $\frac{24}{16} = 1{\cdot}5$

Corresponding Volume Scale Factor = $1{\cdot}5^3 = 3{\cdot}375$

If these shapes were mathematically similar then

V_{Large} should be equal to $V_{Small} \times 3{\cdot}375$.

V_{Large} = $1125 cm^3$

$V_{Small} \times 3{\cdot}375$ = $576 \times 3{\cdot}375$
= $1944\ cm^3$

Since these are not equal,
The cartons are not mathematically similar

b Volume Scale Factor = $\frac{1500}{576}$

Scale Factor = $\sqrt[3]{\frac{1500}{576}}$ =1·3758

New Depth = $Depth_{small} \times$ Scale Factor

= $16 \times 1{\cdot}3758$ ($16 \times$ *Ans* on calc)

= 22.012848326 cm