National 5

Exam Solutions

SQA Exam 2019 Solutions

Paper 1

1. $f(x) = 5x^3$

       $f(-2) = 5 \times (-2)^3$
            $= 5 \times -8$
            $= -40$

2.

$$\frac{3}{8} \times \frac{12}{7}$$

$$\frac{3}{2} \times \frac{3}{7} = \frac{9}{14}$$

3      $(x + 5)(2x^2 - 7x - 3)$

$2x^3 \quad - 7x^2 - 3x$
         $+ 10x^2 - 35x \quad - 15$

$2x^3 \quad + 3x^2 - 38x \quad - 15$

4

$$\frac{240}{360} \times \pi d$$

$$\frac{240}{360} \times 3 \cdot 14 \times 60$$

$$\frac{2}{3} \times 3 \cdot 14 \times 60$$

$40 \times 3 \cdot 14$

$4 \times 31 \cdot 4 = 125 \cdot 6 \text{cm}$

5 3 3 | 4 4 ⑤ 6 7 | 9 10

Q1 = 3·5   Q3 = 8

Median = 5

$$\text{SIQR} = \frac{8-3\cdot5}{2} = \frac{4\cdot5}{2} = 2\cdot25$$

b

Median of Endoch was larger
=> On average the temperatures of Endoch were higher.

SIQR of Endoch was smaller
=> temperatures of Endoch vary less than those of Grantford.

5 a $m = \dfrac{y2-y1}{x2-x1} = \dfrac{8-14}{3\cdot5-1\cdot5} = \dfrac{-6}{2} = -3$

Sub m = −3 and (1·5, 14) into y = mx + c

14 = −3 × 1·5 + x

14 = − 4·5 + c

c = 18·5

y = − 3x + 18·5

b

y = −3 × 1·1 + 18·5

 = − 3·3 + 18·5

 = 15·2 km per litre

7

$$2A = h(x + y)$$

$$2A = hx + hy$$

$$2A - hy = hx$$

$$\frac{2A - hy}{h} = x$$

$$x = \frac{2A - hy}{h}$$

$$2A = h(x + y)$$

$$\frac{2A}{h} = x + y$$

$$\frac{2A}{h} - y = x$$

$$x = \frac{2A}{h} - y$$

8   a $7c + 3g = 215$ ① × 4

    b $5c + 4g = 200$ ② × −3

C $28c + 12g = 860$ ③

     $-15c - 12g = -600$ ④

③ + ④

$$13c = 260$$
$$c = 20$$

Cement 20kg

Sub c = 20 into ②

$$5c + 4g = 200$$

$$100 + 4g = 200$$
$$4g = 100$$
$$g = 25$$

Gravel = 25kg

9.

a   graph turns at (4, 20)

=> line of symmetry at x = 4

b)   y   = $b - (x + a)^2$

At turning point: (x + a) = 0

If x = 4,

$$a = -4$$

If (x + a) = 0, then

$$b = 20$$

10   a

$$\vec{PQ} = \vec{PR} + \vec{RQ}$$

$$\vec{PQ} = \begin{pmatrix} 6 \\ -4 \end{pmatrix} + \begin{pmatrix} -1 \\ 8 \end{pmatrix} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$$
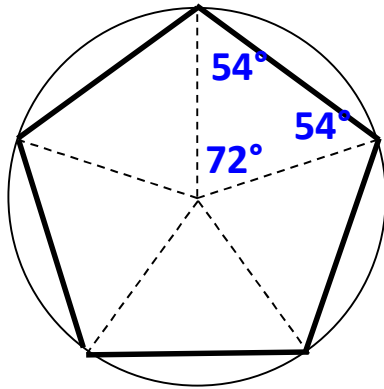
b

$$\vec{MR} = \frac{1}{2}\vec{PR}$$

$$\vec{MR} = \frac{1}{2}\begin{pmatrix} 6 \\ -4 \end{pmatrix} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

$$\vec{MQ} = \vec{MR} + \vec{RQ}$$

$$\vec{MR} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} + \begin{pmatrix} -1 \\ 8 \end{pmatrix} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$$
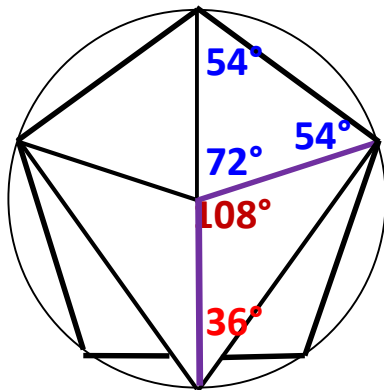
11.

$360 \div 5 \quad = \quad 72$

$180 - 72 \quad = \quad 108$

$108 \div 2 \quad = \quad 54$

$180 \quad - 72 = \quad 108$

2 purple lines are radii

$180 - 108 = \quad 72$

$72 \div 2 \quad = \quad 36°$

12

$$\frac{\sqrt{2}}{\sqrt{40}} = \sqrt{\frac{2}{40}} = \sqrt{\frac{1}{20}} = \frac{1}{\sqrt{20}}$$

$$\frac{1}{\sqrt{20}} = \frac{1}{\sqrt{4}\sqrt{5}} = \frac{1}{2\sqrt{5}}$$

13.   Minimum of cos x is at y = −1

=>   minimum of 3cos   is at   y = −3

Minimum of cos x is usually at 180
Graph is moved 45 left

x = 180 − 45 = 135

A(135, −3)

14   Multiply both sides by 10

$$5x - 10 = 2(3 - x)$$

$$5x - 10 = 6 - 2x$$

$$7x = 16$$

$$x = 16/7$$

15   a

$$h = 12t - 5t^2$$

$$h(2) = 12 \times 2 - 5 \times 2^2$$

$$= 24 - 20$$

$$= 4m$$

b $$12t - 5t^2 = -17$$

$$0 = 5t^2 - 12t - 17$$

$$0 = (5t - 17)(t + 1)$$

$$5t - 17 = 0 \quad \text{or } t + 1 = 0$$

$$5t = 17 \quad\quad \text{or} \quad \cancel{t = -1}$$

$$t = 17/5$$

$$t = 3 \cdot 4s$$

Paper 2

1       $80\,000 \times 1\cdot15^3$

        121 670 packages

2

$$\sqrt{6^2 + 27^2 + (-18)^2}$$
$$\sqrt{1089}$$

        33

3   A   =   ½ ab sin C

        A   =   ½ 45 × 70 × sin 129

        A   =   1224·0 cm²

4       $0\cdot08 \times 3\cdot6 \times 10^{-6}$

        $2\cdot88 \times 10^{-7}$

5   Cone has diameter 6 => radius = 3 units

        A (3, 0, 0)

        B (3, 3, 8)

6        $a = 3,$ $b = 9$ and $c = -2$

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

$$x = \frac{-9 \pm \sqrt{9^2 - 4 \times 3 \times -2}}{2 \times 3}$$

$$x = \frac{-9 \pm \sqrt{81 - -24}}{6}$$

$$x = \frac{-9 \pm \sqrt{105}}{6}$$

x = 0·2078   or   −3·207

x = 0·2   or   −3·2

7   Smallest angle is opposite smallest side

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

$$\cos Z = \frac{7 \cdot 2^2 + 8 \cdot 5^2 - 6 \cdot 3^2}{2 \times 7 \cdot 2 \times 8 \cdot 5}$$

$$\cos Z = \frac{84 \cdot 4}{122 \cdot 4} = 0 \cdot 6895$$

Z   =   46·4°

8   V_{CYL} = $\pi r^2 h$

         = $\pi \times 12^2 \times 58$ $3\cdot14 \times 12^2 \times 58$

         = 26238·58184   26225·28

    V_{HEM} = ½ $\frac{4}{3} \times \pi r^3$

         = ½ $\frac{4}{3} \times \pi \times 12^3$ ½ $\frac{4}{3} \times 3\cdot14 \times 12^3$

         = 3619·114737   3617·28

    V_{TOT} = 29857·69658   29842·56

         = 30000 cm³   29900 cm³

9   102·5%   =   977·85

                                   ÷ 102·5

    1%   =   9·54

                                     × 2·5

    2·5%   =   £23·85

10    $x^2 + 10x - 15$

    $(x + 5)^2 +$ ___

    $(x^2 + 10x + 25) +$ ____

    $(x + 5)^2 - 40$

11   Perimeter   =   600 + 650 + _____   = 1500

3rd side   =   250

Let a = 600, b = 250 and c = 650

$a^2 + b^2$ = $600^2 + 250^2$
            =   422500

    c^2 = 650^2
            =   422500

$a^2 + b^2$ = c^2

Therefore by the converse of pythagoras this is a right angled triangle with right angle at ABC.

Since ABC is a right angle then B is due east of A

12

Scale Factor $= \dfrac{50}{30} = \dfrac{5}{3}$ $(1{\cdot}66\ldots)$

Area Scale Factor $= \left(\dfrac{5}{3}\right)^2 = \dfrac{25}{9}$ $(2{\cdot}77\ldots)$

Small Area $= 2750 \div \dfrac{25}{9}$

$= 990 \text{ cm}^2$

b $\dfrac{x}{360} \times \pi \times 30^2 = 990$

$\dfrac{900\pi x}{360} = 990$

$2{\cdot}5\pi x = 990$

$x = 126{\cdot}05°$

13         $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

             $= \dfrac{4p^2 - 9}{4p - 6}$

             $= \dfrac{(2p-3)(2p+3)}{2(2p-3)}$

             $= \dfrac{(2p+3)}{2}$

14         $5 \cos x + 2 = 1$
             $5 \cos x = -1$

             $\cos x = -1/5$

Base Angle: $x = \cos^{-1}(+0 \cdot 2)$

               $x = 78 \cdot 5°$

Cos is negative in Q2 & Q 3

In Q2 $x = 180 - 78 \cdot 5$
               $= 101 \cdot 5°$

In Q3 $x = 180 + 78 \cdot 5$
               $= 258 \cdot 5°$

15

$$\frac{4(x+5)}{(x-2)(x+5)} - \frac{3(x-2)}{(x+5)(x-2)}$$

$$\frac{4(x+5) - 3(x-2)}{(x-2)(x+5)}$$

$$\frac{4x+20-3x+6}{(x-2)(x+5)}$$

$$\frac{x+26}{(x-2)(x+5)}$$

16

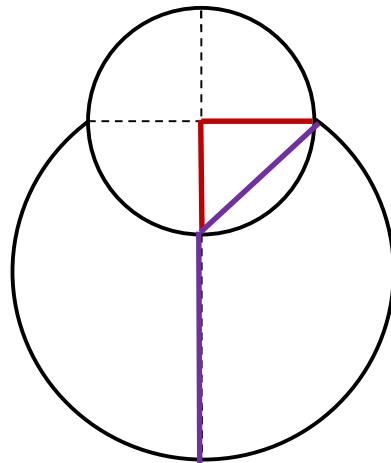$$\frac{a^4 \times 3a}{\sqrt{a}}$$
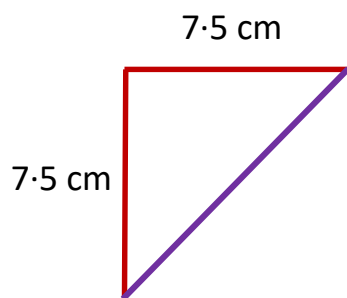
$$\frac{3a^5}{a^{1/2}}$$

$$3a^{\frac{9}{2}}$$

17   (sin x + cos x)²

sin²x +   2 sinx cosx + cos²x   (sin²x + cos²x = 1)

2 sin x cos x

18

Both purple lines are radii

Of the larger circle

r^2 = $7.5^2 + 7.5^2$

r^2 = 112.5

r = 10.6 cm

CD = $10.6 + 15$

= 25.6 cm