



2017 National 5 Mathematics Paper 1

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Question 1, (2)

$$\begin{aligned}f(-5) &= (-5)^2 + 3(-5) \\ &= 25 - 15 \\ &= 10\end{aligned}$$

Question 2, (2)

Ordering the data gives

198 216 218 230 232 247 248 250 265 267

$$Q_1 = 218$$

$$Q_3 = 250$$

$$\begin{aligned}\text{Semi-interquartile range} &= \frac{Q_3 - Q_1}{2} \\ &= \frac{250 - 218}{2} \\ &= 16\end{aligned}$$

Question 3, (2)

$$\begin{aligned}1\frac{5}{6} \div \frac{3}{4} &= \frac{11}{6} \div \frac{3}{4} \\ &= \frac{11}{6} \times \frac{4}{3} \\ &= \frac{44}{18} \\ &= \frac{22}{9}\end{aligned}$$

Question 4, (3)

$$\begin{aligned}(2x + 3)(x^2 - 4x + 1) \\ &= 2x^3 - 8x^2 + 2x + 3x^2 - 12x + 3 \\ &= 2x^3 - 5x^2 - 10x + 3\end{aligned}$$

**Question 5, (2)**

$$B = (0, 6, 6)$$

$$C = (3, 3, 9)$$

Question 6, (3)

$$\begin{aligned} m_{AB} &= \frac{6 - (-2)}{-1 - 3} \\ &= -2 \end{aligned}$$

Using $y - b = m(x - a)$ with $(3, -2)$ gives

$$y - (-2) = -2(x - 3)$$

$$y + 2 = -2x + 6$$

$$y = -2x + 4$$

Question 7, (2)

$$\begin{aligned} \text{Area} &= \frac{1}{2} df \sin E \\ &= \frac{1}{2} \times 12 \times 8 \times \frac{2}{3} \\ &= 32 \text{ cm}^2 \end{aligned}$$

Question 8, (3)

$$19 + x > 15 + 3(x - 2)$$

$$19 + x > 15 + 3x - 6$$

$$10 > 2x$$

$$5 > x$$

$$\text{So, } x < 5$$

Question 9, (3)

$$\text{OBE} = 90^\circ$$

$$\text{OBD} = 90 - 58 = 32^\circ$$

$\text{ODB} = 32^\circ$ since isosceles triangle

$$\text{DOB} = 180 - (32 \times 2) = 116^\circ$$

$$\text{BOC} = 180 - 116 = 64^\circ$$

$$\text{CAB} = 180 - 90 - 64 = 26^\circ$$



Question 10, (3)

$$F = \frac{t^2 + 4b}{c}$$

$$Fc = t^2 + 4b$$

$$Fc - t^2 = 4b$$

$$b = \frac{Fc - t^2}{4}$$

Question 11, (2)

$$\begin{aligned} \frac{3}{a^2} - \frac{2}{a} &= \frac{3}{a^2} - \frac{2a}{a^2} \\ &= \frac{3-2a}{a^2} \end{aligned}$$

Question 12, (4)

$$\bar{x} = \frac{1 + 4 + 6 + 3 + 6}{5} = 4$$

x	$x - \bar{x}$	$(x - \bar{x})^2$
1	-3	9
4	0	0
6	2	4
3	-1	1
6	2	4
		$\sum (x - \bar{x})^2 = 18$

$$\text{Standard Deviation} = \sqrt{\frac{18}{4}} = \frac{\sqrt{18}}{\sqrt{4}} = \frac{2\sqrt{3}}{2}$$

$$a = 3, b = 2$$

**Question 13, (3)**

$$3x - y = 2 \quad (1)$$

$$x + 3y = 19 \quad (2)$$

$$9x - 3y = 6 \quad (3)$$

$$x + 3y = 19 \quad (2)$$

(3) + (2) gives

$$10x = 25$$

$$x = 2.5$$

Substitute $x = 2.5$ into (1) to give

$$(3 \times 2.5) - y = 2$$

$$7.5 - y = 2$$

$$y = 5.5$$

So, $P = (2.5, 5.5)$

Question 14, (2) (1)

a) $a = 5$

b) $y = (x + 5)^2 + b$

Substituting the point $(-3, 8)$ gives

$$8 = (-3 + 5)^2 + b$$

$$8 = 4 + b$$

$$b = 4$$

Question 15, (3)

Linear scale factor = $\frac{5}{7}$. Set up as a 'reduction' to give

$$x = \frac{5}{7} \cdot (x + 2.6)$$

$$7x = 5(x + 2.6)$$

$$7x = 5x + 13$$

$$2x = 13, x = 6.5 \text{ cm}$$



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Question 1, (2)

$$\begin{aligned} \underline{v} &= \sqrt{18 + (-14)^2 + 3^2} \\ &= \sqrt{529} \\ &= 23 \end{aligned}$$

Question 2, (3)

$$\begin{aligned} &1200 \times 1.045^3 \\ &= 1369.39 \\ \text{Value} &= \text{£}1369 \end{aligned}$$

Question 3, (3)

Using the Cosine Rule gives

$$\begin{aligned} p^2 &= q^2 + r^2 - 2qr \cos P \\ &= 180^2 + 150^2 - 2 \times 180 \times 150 \times \cos 147 \\ &= 170,380 \end{aligned}$$

$$p = \sqrt{170,380} = 413$$

Length = 413 m

Question 4, (3)

$$2x^2 + 5x - 4 = 0$$

$$a = 2, b = 5, c = -4$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2}$$

$$x = \frac{-5 \pm \sqrt{25 + 32}}{4}$$

$$x = \frac{-5 + \sqrt{57}}{4} = 0.6$$

$$x = \frac{-5 - \sqrt{57}}{4} = -3.1$$

**Question 5, (3)**

$$4,800 = 115\%$$

$$1\% = \frac{4,800}{115} = 42$$

$$100\% = 42 \times 100 = 4,200$$

Question 6, (5)

$$\text{Volume of outer sphere} = \frac{4}{3} \times \pi \times 12^3 = 7,240 \text{ mm}^3.$$

$$\text{Volume of inner sphere} = \frac{4}{3} \times \pi \times 9^3 = 3,050 \text{ mm}^3.$$

$$\text{Volume of coating} = 7,240 - 3,050 = 4,190 \text{ mm}^3.$$

Question 7, (3)

The hypotenuse of the larger triangle is 22 cm.

The short sides have length 8 cm and 19 cm.

$$8^2 + 19^2 = 425$$

$$22^2 = 484$$

Since $425 \neq 484$ the triangle is not right angled by the converse of Pythagoras.

Question 8, (1) (2)

$$\text{a) } \overrightarrow{PR} = -\underline{d} - \underline{c}$$

$$\text{b) } \overrightarrow{TV} = \overrightarrow{TP} + \frac{1}{2}\overrightarrow{PR}$$

$$= -\underline{d} + \frac{1}{2}(-\underline{d} - \underline{c})$$

$$= -\frac{3}{2}\underline{d} - \frac{1}{2}\underline{c}$$

Question 9, (1) (3)

$$\text{a) } 4x^2 - 25 = (2x)^2 - 5^2$$

$$= (2x - 5)(2x + 5)$$

$$\text{b) } \frac{4x^2 - 25}{2x^2 - x - 10} = \frac{(2x - 5)(2x + 5)}{(2x - 5)(x + 2)}$$

$$= \frac{2x + 5}{x + 2}$$

**Question 10, (4)**

$$EDF = 126 - 90 = 36^\circ$$

$$DEF = 360 - 230 - 90 = 40^\circ$$

$$\text{So, } DFE = 180 - 36 - 40 = 104^\circ.$$

Using the Sine Rule gives

$$\frac{f}{\sin F} = \frac{e}{\sin E}$$

$$\frac{15}{\sin 104} = \frac{DF}{\sin 40}$$

$$DF = \frac{15 \sin 40}{\sin 104}$$

$$DF = 9.9$$

$$\text{Distance} = 9.9 \text{ km}$$

Question 11, (2)

$$3x - 5y - 10 = 0$$

$$3x - 10 = 5y$$

$$5y = 3x - 10$$

$$y = \frac{3}{5}x - 2$$

So, the gradient of the line is $\frac{3}{5}$.

Question 12, (2)

$$\frac{1}{\sqrt[3]{x}} = \frac{1}{x^{\frac{1}{3}}} = x^{-\frac{1}{3}}$$

Question 13, (4)

Let C be the midpoint of AB

$$\text{Then, } AC = 24 \text{ cm}$$

Let D be the midpoint of AC

$$\text{Then, } AD = 12 \text{ cm.}$$

Construct a right angled triangle A, C₁, D



Using Pythagoras gives

$$14^2 + 12^2 = (DC_1)^2$$

$$196 + 144 = (DC_1)^2$$

$$DC_1 = \sqrt{340} = 7.2 \text{ cm}$$

$$\text{Height} = (7.2 \times 2) + (14 \times 2) = 42.4 \text{ cm}$$

Question 14, (3)

$$\text{Arc length} = \frac{\text{angle}}{360} \times \pi \times d$$

$$31.5 = \frac{AOB}{360} \times \pi \times 12.8$$

Rearranging gives

$$AOB = \frac{31.5 \times 360}{12.8\pi}$$

$$AOB = 282^\circ$$

Question 15, (1) (1) (4)

a) $h = 40 + 23 \cos x$

When $x = 60^\circ$

$$\begin{aligned} h &= 40 + 23 \cos 60^\circ \\ &= 51.5 \text{ m} \end{aligned}$$

b) Minimum height occurs where $x = 180^\circ$

$$\begin{aligned} h &= 40 + 23 \cos 180^\circ \\ &= 17 \text{ m} \end{aligned}$$

c) Let $h = 61$ to give

$$61 = 40 + 23 \cos x$$

$$\cos x = \frac{21}{23}$$

$$x = \cos^{-1}\left(\frac{21}{23}\right) = 24^\circ$$

$$x = 360 - 24 = 336^\circ$$