2017 National 5 Paper 1

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Marks are indicated in brackets after each question

Question 1, (2)

$$f(-5) = (-5)^2 + 3(-5)$$
$$= 25 - 15$$
$$= 10$$

Question 2, (2)

Ordering the data gives

198 216 218 230 232 247 248 250 265 267

$$Q_1 = 218$$

$$Q_3 = 250$$

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

Question 3, (2)

$$1\frac{5}{6} \div \frac{3}{4} = \frac{11}{6} \div \frac{3}{4}$$
$$= \frac{11}{6} x \frac{4}{3}$$
$$= \frac{44}{18}$$
$$= \frac{22}{9}$$

Question 4, (3)

$$(2x+3)\left(x^2-4x+1\right)$$
$$=2x^3-8x^2+2x+3x^2-12x+3$$
$$=2x^3-5x^2-10x+3$$

Question 5, (2)

$$B=(0,6,6)$$
$$C=(3,3,9)$$

Question 6, (3)

$$m_{AB}=\frac{6-(-2)}{-1-3}$$
$$=-2$$

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)

$$\text{Area}=\frac{1}{2}df\sin E$$
$$=\frac{1}{2}\,x\,12\,x\,8\,x\frac{2}{3}$$
$$=32\ cm^2$$

Question 8, (3)

$$19+x>15+3(x-2)$$
$$19+x>15+3x-6$$
$$10>2x$$
$$5>x$$

So, $x<5$

Question 9, (3)

OBE $= 90°$

OBD $= 90 - 58 = 32°$

ODB $= 32°$ since isosceles triangle

DOB $= 180 - (32\ x\ 2) = 116°$

BOC $= 180 - 116 = 64°$

CAB $= 180 - 90 - 64 = 26°$

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)

$$\frac{3}{a^2} - \frac{2}{a} = \frac{3}{a^2} - \frac{2a}{a^2}$$

$$= \frac{3 - 2a}{a^2}$$

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
		$\sum (x - \bar{x})^2 = 18$

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

$a = 3, b = 2$

Question 13, (3)

$3x - y = 2$ (1)

$x + 3y = 19$ (2)

Multiplying (1) by three gives

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

$x + 3y = 19$ (2)

(3) + (2) gives

$10x = 25$

$x = 2.5$

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

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

$$7.5 - y = 2$$

$$y = 5.5$$

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

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

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

$$7x = 5x + 13$$

$$2x = 13,\ x = 6.5\ cm$$

2017 National 5 Paper 2

Question 1, (2)

$$\underline{v} = \sqrt{18 + (-14)^2 + 3^2}$$

$$= \sqrt{529}$$

$$= 23$$

Question 2, (3)

$$1200\ x\ 1.045^3$$

$$= 1369.39$$

Value $= £1369$

Question 3, (3)

Using the Cosine Rule gives

$$p^2 = q^2 + r^2 - 2qr\cos P$$

$$= 180^2 + 150^2 - 2\ x\ 180\ x\ 150\ x\cos 147$$

$$= 170, 380$$

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

Length $= 413\ m$

Question 4, (3)

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

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

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

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

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

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

Question 5, (3)

$$4{,}800 = 115\%$$

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

$$100\% = 42\ x\ 100 = 4{,}200$$

Question 6, (5)

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

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

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

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)

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

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)

a) $4x^2 - 25 = (2x)^2 - 5^2$

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

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)

$EDF = 126 - 90 = 36°$

$DEF = 360 - 230 - 90 = 40°$

So, $DFE = 180 - 36 - 40 = 104°$

Using the Sine Rule gives

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

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

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

$$DF = 9.9$$

Distance $= 9.9\ km$

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

Then, $AC = 24\ cm$

Let D be the midpoint of AC

Then, $AD = 12\ cm$

Construct a right angled triangle $A,\ C_1,\ D$

Using Pythagoras gives

$$14^2 + 12^2 = (DC_1)^2$$
$$196 + 144 = (DC_1)^2$$
$$DC_1 = \sqrt{340} = 7.2\ cm$$

Height $= (7.2\ x\ 2) + (14\ x\ 2) = 42.4\ cm$

Question 14, (3)

Arc length $= \frac{angle}{360} \, x \, \pi \, x \, d$

$31.5 = \frac{AOB}{360} \, x \, \pi \, x \, 12.8$

Rearranging gives

$AOB = \frac{31.5 \, x \, 360}{12.8\pi}$

$AOB = 282°$

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

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

When $x = 60°$

$h = 40 + 23\cos 60°$

$= 51.5 \, m$

b) Minimum height occurs where $x = 180°$

$h = 40 + 23\cos 180°$

$= 17 \, m$

c) Let $h = 61$ to give

$61 = 40 + 23\cos x$

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

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

$x = 360 - 24 = 336°$