2018 National 5 Paper 1

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Marks are indicated in brackets after each question

Question 1, (2)

$$2\frac{1}{3}+\frac{4}{5}=\frac{7}{3}+\frac{4}{5}=\frac{35}{15}+\frac{12}{15}=\frac{47}{15}=3\frac{2}{15}$$

Question 2, (3)

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

$$=3x^2+x-3x-1+2x^2-10$$

$$=5x^2-2x-11$$

Question 3, (3)

$4x+5y=-3$ (1)

$6x-2y=5$ (2)

Multiply (1) by 2 and multiply (2) by 5 to give

$8x+10y=-6$ (3)

$30x-10y=25$ (4)

(3) + (4) gives

$$38x=19$$

$$x=0.5$$

Substitute $x=0.5$ into (1) to give

$$4\,x\,0.5+5y=-3$$

$$2+5y=-3$$

$$5y = -5,\ y = -1$$

Question 4, (2)

$$\underline{u} + \underline{v} = \begin{pmatrix} 1 \\ 5 \\ 1 \end{pmatrix} + \begin{pmatrix} v_1 \\ v_2 \\ v_3 \end{pmatrix} = \begin{pmatrix} 6 \\ -4 \\ 3 \end{pmatrix}$$

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

Question 5, (2)

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

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

$x - 8 = 0$ and $x - 3 = 0$

$$x = 8$$

$$x = 3$$

Question 6, (2)

$$y = 5\cos 4x$$

$$a = 5,\ b = 4$$

Question 7, (3) (1)

a) $A = (8, 14),\ B = (12, 20)$

Gradient $= \dfrac{20 - 14}{12 - 8} = \dfrac{6}{4} = \dfrac{3}{2}$

Write $y = mx + c$ using P and d to give

$$P = md + c$$

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

Substitute $(8, 14)$ to give

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

$$14 = 12 + c$$

$$c = 2$$

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

b) Let $d = 5$ to give

$$P = \frac{3}{2}(5) + 2$$

$$= \frac{15}{2} + 2$$

$$= 7.5 + 2$$

$$= 9.5$$

So, £ 9.50

Question 8, (2)

$$f(x) = 2x^2 + 4x + 5$$

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

$$b^2 - 4ac = 4^2 - 4(2)(5)$$

$$= 16 - 40$$

$$= -24$$

So, no real roots

Question 9, (2)

$360 \div 10 = 36$

$180 - 36 = 144$

$144 \div 2 = 72$

$180 - 72 = 108$

$17 + 108 = 125$

Shaded Area $= 180 - 125 = 55°$

Question 10, (3)

$z^2 = x^2 + y^2 - 2xy\cos Z$

$= 8^2 + 10^2 - 2(8)(10)(\frac{1}{8})$

$= 164 - 20$

$= 144$

$z = 12$

So, $XY = 12$ cm

Question 11, (2)

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

Question 12, (1)

Sketch the graph of $y = \cos x$

Mark on a horizontal line through 0.5

The line passes through the graph where $x = 60$

From the symmetry of the graph, $\cos 240° = -0.5$ (Or use a CAST diagram)

Question 13, (2)

$B = \left(4, 8, 5\right),\ C = (6, 8, 0)$

Question 14, (3)

$y = g\sqrt{x} + h$

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

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

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

Question 15, (2)

$\left(\dfrac{2}{3}p^4\right)^2 = \dfrac{4}{9}p^8$

Question 16, (3)

$y = (x - 6)(x + 4)$

For roots, let $y = 0$ to give

$0 = (x - 6)(x + 4)$

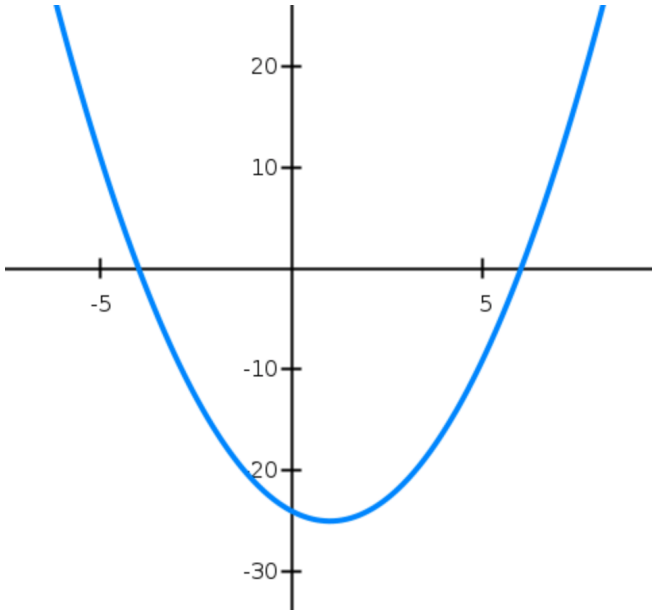
$x = -4, x = 6$

For $y-$ intercept, let $x = 0$ to give

$y = \left(0 - 6\right)(0 + 4)$

$= (-6)(4)$

$= -24$



Question 17, (3)

Volume $= \frac{1}{3}Ah$

$138 = \frac{1}{3}\, x\, 6^2\, x\, h$

$138 = 12h$

$h = \frac{138}{12} = \frac{69}{6} = 11.5$

$h = 11.5$ cm

Question 18, (2)

$\sin x \cos x \tan x$

Substitute $\tan x = \frac{\sin x}{\cos x}$ to give

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

$= \sin x \sin x$

$= sin^2 x$

Question 19, (2) (1) (4)

a) i) $x^2 - 6x - 81 = (x-3)^2 - 9 - 81$

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

ii) $x = 3$

b) $x^2 - 6x - 81 = 0$

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

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

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

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

2018 National 5 Paper 2

Question 1, (3)

$125{,}000\ x\ 0.98^3 = 117,649$

$117,649$ tonnes

Question 2, (3)

Arc Length $= \frac{320}{360}\ x\ \pi\ x\ 14.8 = 41.3$

$= 41.3$ cm

Question 3, (2)

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

$= \sqrt{784}$

$= 28$

Question 4, (3)

$3x < 6(x-1) - 12$

$3x < 6x - 6 - 12$

$3x < 6x - 18$

$18 < 3x$

$6 < x$

$x > 6$

Question 5, (4) (2)

a) Mean $= \bar{x} = \frac{756}{6} = 126$

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

Standard Deviation $= \sqrt{\frac{82}{5}} = 4.0$

b) Since the mean has decreased fewer people visited on a Sunday on average.
Since the standard deviation has increased the number of people visiting stalls on Sunday is less consistent.

Question 6, (2)

$f(x) = 5 + 4x$

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

Dropping $f(a)$ gives

$5 + 4a = 73$

$4a = 73 - 5$

$4a = 68$

$a = \frac{68}{4} = 17$

Question 7, (3)

$$v = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\, x\, \pi\, x\, 3.2^2$$

$$= 137.2582$$

$$= 140\ cm^3$$

Question 8, (3)

$$7\sin x + 2 = 3$$

$$\sin x = \frac{1}{7}$$

$$x = sin^{-1}\left(\frac{1}{7}\right) = 8.2°$$

From CAST diagram

$$x = 180 - 8.2 = 171.8°$$

Question 9, (3)

Using the Sine Rule gives

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

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

$$= 32 \text{ cm}$$

Question 10, (2)

$$\vec{BC} = \vec{BA} + \vec{AE} + \vec{ED} + \vec{DC}$$

$$= -\underline{u} - \underline{w} + 2\underline{u} + \frac{1}{2}\underline{w}$$

$$= \underline{u} - \frac{1}{2}\underline{w}$$

Question 11, (3)

$$85\% = 9.3\ x\ 10^{11}$$

$$1\% = (9.3\ x\ 10^{11}) \div 85$$

$$100\% = \left[\left(9.3\ x\ 10^{11}\right) \div 85\right]\ x\ 100$$

$$= 1{,}094{,}117{,}647{,}058$$

$$= 1.09\ x\ 10^{2}$$

Question 12, (4)

Let M be the mid-point of AB

Construct a right-angled triangle OAM

Using Pythagoras, $13^2 - 10^2 = 169 - 100 = 69$

$$\sqrt{69} = 8.3$$

Width = Radius + $8.3 = 13 + 8.3 = 21.3$ cm

Question 13, (4)

$$\cos T = \frac{5.6^2 + 10.3^2 - 7.2^2}{2\ x\ 5.6\ x\ 10.3}$$

$$= \frac{85.61}{115.36}$$

$$= 0.742\ \ldots$$

$$T = cos^{-1}(0.742\ \ldots)$$

$= 42°$

Bearing $= 240 + 42$

$= 282°$

Question 14, (2)

$2x - 5y = 20$

For $y-$ intercept, let $x = 0$

$0 - 5y = 20$

$-5y = 20$

$y = -4$

Giving $(0, -4)$

Question 15, (3)

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

$$= \frac{n}{n^2 - 4} x \frac{n - 2}{3}$$

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

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

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

Question 16, (4)

Construct a right-angled triangle in the base of the cuboid

Sides of this triangle are 40 cm and 40 cm

Using Pythagoras, long side of this triangle $= \sqrt{40^2 + 40^2} = 56.57$

Construct a right-angled triangle with corners P & M

Sides of this triangle are 70 cm and 56.57 cm

Using Pythagoras gives

$PM = \sqrt{70^2 + 56.57^2}$

$= 90$

So, $PM = 90$ cm

Since the umbrella is only 85 cm, it will fit

Question 17, (5)

Area of Triangle $= \frac{1}{2}(38)(55)\sin 75$

$= 1009.39\ cm^2$

Area of Sector $= \frac{75}{360}\ x\ \pi\ x\ 60$

$= 39.27\ cm^2$

Shaded Area $= 1009.39 - 39.27$

$= 970.12\ cm^2$

Question 18, (3)

a) Linear Scale Factor $= \frac{24}{16} = 1.5$

Volume Scale Factor $= 1.5^3 = 3.375$

$\frac{1125}{576} = 1.96$

Since $1.96 \neq 3.375$ the two cartons are not mathematically similar

b) Volume Scale Factor $= \frac{1500}{576} = 2.6$

$$2.6 = \left(\frac{d}{16}\right)^3$$

$$2.6 = \frac{d^3}{16^3}$$

$$2.6 \; x \; 16^3 = d^3$$

$$d^3 = 10,\, 649.6$$

$$d = \sqrt[3]{10,\, 649.6}$$

$$d = 22 \text{ cm}$$