2018 National 5 Mathematics Paper 1

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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 $x - 3 = 0$

$x = 8$ and $x = 3$

Question 6, (2)

$a = 5, b = 4$

Question 7, (3) (1)

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

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

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

$P = md + c$

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

Substitute $(8, 14)$ to give

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

$14 = 12 + c$

$c = 2$

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

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)

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

Question 14, (3)

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

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

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

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

Question 15, (2)

$$(\frac{2}{3}p^4)^2 = \frac{4}{9}p^8$$

Question 16, (3)

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

For roots, let $y = 0$ to give

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

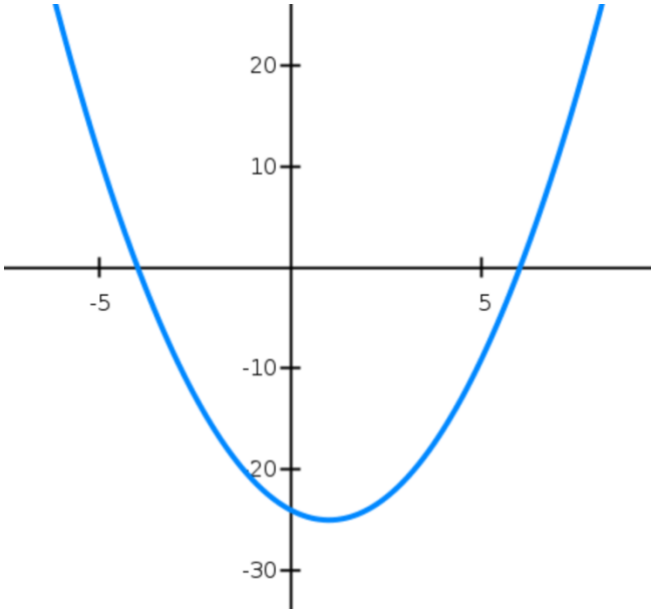
$x = -4, x = 6$

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

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

$= (-6)(4)$

$= -24$



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 Mathematics Paper 2

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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)

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

$= \sqrt{784}$

$= 28$

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

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

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

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

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

$= 32$ cm

Question 10, (2)

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

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

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

Question 11, (3)

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

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

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

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

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

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)

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

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

$$= 0.742\ ..$$

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

$= 42°$

Bearing $= 240 + 42$

$= 282°$

Question 14, (2)

$2x - 5y = 20$

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

$0 - 5y = 20$

$-5y = 20$

$y = -4$

$(0, -4)$

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 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) (2)

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 $= \frac{1500}{576} = 2.6$

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

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

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

$d^3 = 10,649.6$

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

$d = 22$ cm