

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)

$$\begin{aligned}(3x + 1)(x - 1) + 2(x^2 - 5) \\ &= 3x^2 + x - 3x - 1 + 2x^2 - 10 \\ &= 5x^2 - 2x - 11\end{aligned}$$

Question 3, (3)

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

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

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

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

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

(3) + (4) gives

$$38x = 19$$

$$x = 0.5$$

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

$$4 \times 0.5 + 5y = -3$$

$$2 + 5y = -3$$

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

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)

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

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

$$x - 8 = 0 \text{ and } x - 3 = 0$$

$$x = 8$$

$$x = 3$$

Question 6, (2)

$$y = 5\cos 4x$$

$$a = 5, b = 4$$

Question 7, (3) (1)

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

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

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)

$$360 \div 10 = 36$$

$$180 - 36 = 144$$

$$144 \div 2 = 72$$

$$180 - 72 = 108$$

$$17 + 108 = 125$$

$$\text{Shaded Area} = 180 - 125 = 55^\circ$$

Question 10, (3)

$$\begin{aligned}z^2 &= x^2 + y^2 - 2xy\cos Z \\ &= 8^2 + 10^2 - 2(8)(10)\left(\frac{1}{8}\right) \\ &= 164 - 20 \\ &= 144 \\ z &= 12\end{aligned}$$

So, $XY = 12$ cm

Question 11, (2)

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

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, $\cos 240^\circ = -0.5$ (Or use a CAST diagram)

Question 13, (2)

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

Question 14, (3)

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

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

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

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

Question 15, (2)

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

Question 16, (3)

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

For roots, let $y = 0$ to give

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

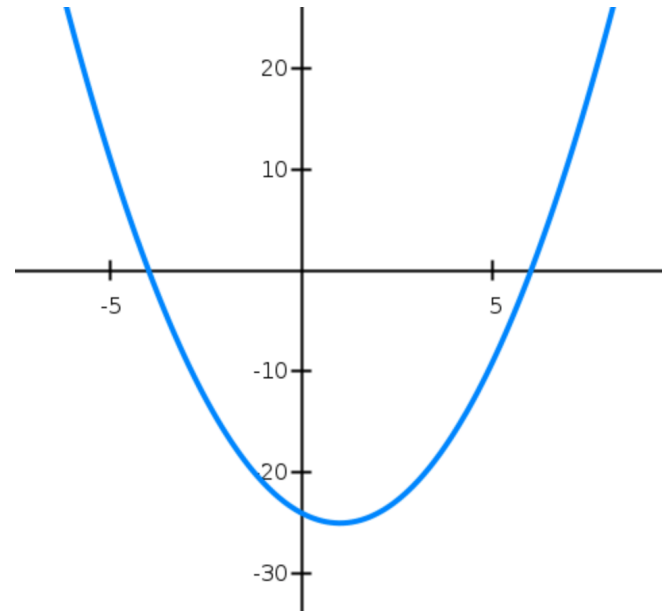
$$x = -4, x = 6$$

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

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

$$= (-6)(4)$$

$$= -24$$



Question 17, (3)

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

$$138 = \frac{1}{3}x6^2xh$$

$$138 = 12h$$

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

$$h = 11.5 \text{ cm}$$

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)

$$\begin{aligned} \text{a) i) } x^2 - 6x - 81 &= (x - 3)^2 - 9 - 81 \\ &= (x - 3)^2 - 90 \end{aligned}$$

$$\text{ii) } x = 3$$

$$\text{b) } x^2 - 6x - 81 = 0$$

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

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

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

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

Question 1, (3)

$$125,000 \times 0.98^3 = 117,649$$

117,649 tonnes

Question 2, (3)

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

$$= 41.3 \text{ cm}$$

Question 3, (2)

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

$$= \sqrt{784}$$

$$= 28$$

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

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)

$$\begin{aligned}v &= \frac{4}{3}\pi r^3 \\&= \frac{4}{3} \times \pi \times 3.2^2 \\&= 137.2582 \\&= 140 \text{ cm}^3\end{aligned}$$

Question 8, (3)

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

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

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

From CAST diagram

$$x = 180 - 8.2 = 171.8^\circ$$

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)

$$\begin{aligned}\vec{BC} &= \vec{BA} + \vec{AE} + \vec{ED} + \vec{DC} \\&= -\underline{u} - \underline{w} + 2\underline{u} + \frac{1}{2}\underline{w} \\&= \underline{u} - \frac{1}{2}\underline{w}\end{aligned}$$

Question 11, (3)

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

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

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

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

$$= 1.09 \times 10^2$$

Question 12, (4)

Let M be the mid-point of AB

Construct a right-angled triangle OAM

$$\text{Using Pythagoras, } 13^2 - 10^2 = 169 - 100 = 69$$

$$\sqrt{69} = 8.3$$

$$\text{Width} = \text{Radius} + 8.3 = 13 + 8.3 = 21.3 \text{ cm}$$

Question 13, (4)

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

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

$$= 0.742 \dots$$

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

$$= 42^\circ$$

$$\text{Bearing} = 240 + 42$$

$$= 282^\circ$$

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)

$$\begin{aligned} \frac{n}{n^2 - 4} \div \frac{3}{n - 2} \\ &= \frac{n}{n^2 - 4} \times \frac{n - 2}{3} \\ &= \frac{n(n - 2)}{3(n^2 - 4)} \\ &= \frac{n(n - 2)}{3(n - 2)(n - 2)} \\ &= \frac{n}{3(n - 2)} \end{aligned}$$

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

$$\begin{aligned} PM &= \sqrt{70^2 + 56.57^2} \\ &= 90 \end{aligned}$$

So, $PM = 90$ cm

Since the umbrella is only 85 cm, it will fit

Question 17, (5)

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

$$= 1009.39 \text{ cm}^2$$

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

$$= 39.27 \text{ cm}^2$$

$$\text{Shaded Area} = 1009.39 - 39.27$$

$$= 970.12 \text{ cm}^2$$

Question 18, (3)

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

$$\text{Volume Scale Factor} = 1.5^3 = 3.375$$

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

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

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

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

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

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

$$d^3 = 10,649.6$$

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

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