2015 National 5 Mathematics Paper 1

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Question 1, (2)

$$6\frac{1}{5} - 2\frac{1}{3} = \frac{31}{5} - \frac{7}{3}$$

$$= \frac{93}{15} - \frac{35}{15}$$

$$= \frac{93-35}{15}$$

$$= \frac{58}{15}$$

Question 2, (3)

$$11 - 2(1 + 3x) < 39$$

$$11 - 2 - 6x < 39$$

$$-6x < 30$$

$$x > \frac{30}{-6}$$

$$x > -5$$

Question 3, (3)

DFE $= 90°$ since triangle inscribed in a circle with one side being the diameter

So, FDE $= 180 - 90 - 64 = 26°$.

ABO $= 90°$ since tangent to the circle.

So, OBD $= 90 - 77 = 13°$.

And BDO $= 13°$ since isosceles triangle.

So, BDF $= 26 + 13 = 39°$.

Question 4, (3)

$(x-4)(x^2+x-2)$

$= x^3 + x^2 - 2x - 4x^2 - 4x + 8$

$= x^3 - 3x^2 - 6x + 8$

Question 5, (3)

$\overline{x} = \frac{1+2+2+2+8}{5} = 3$

x	$x - \overline{x}$	$(x-\overline{x})^2$
1 **2** **2** **2** **8**	**−2** **−1** **−1** **−1** **5**	**4** **1** **1** **1** **25**
		$\sum(x-\overline{x})^2 = 32$

Standard Deviation $= \sqrt{\frac{32}{4}} = \sqrt{8}$

So, $\sqrt{8} = \sqrt{a}$

$a = 8$

Question 6, (2)

Since the amplitude is 4, $a = 4$.

Since there are 3 copies of the Sine graph is $0 \leq x \leq 360°$, $b = 3$.

Question 7, (1) (1) (1)

a) i) $a = -2$

ii) $b = -4$

b) $x = -4$

Question 8, (3)

Let $A = (-2, 5), B = (3, 15)$

$$m_{AB} = \frac{15 - 5}{3 - (-2)} = 2$$

Using $y - b = m(x - a)$ with $(3, 15)$ we have

$y - 15 = 2(x - 3)$

$y - 15 = 2x - 6$

$y = 2x + 9$

Question 9, (2)

$\cos 90° = 0$.

$\cos 100° < 0$ from inspection of the graph.

$\cos 300° > 0$ from inspection of the graph.

So, $\cos 100° < \cos 90° < \cos 300°$

Question 10, (3) (2)

a) {12 16 17 18 18 21 22 26 27 27}

Median $= Q_2 = \frac{18+21}{2} = 19.5$

$Q_1 = 17, Q_3 = 26$

Semi-interquartile Range $= \frac{26-17}{2} = 4.5$.

b) The median has increased and the semi-interquartile range has decreased. This means that on average the couples have scored better in the second round but because the semi-interquartile range has decreased the scores are less consistent than they were in the first round.

Question 11, (3)

$3x + 2y = 17 \quad (1)$

$2x + 5y = 4 \quad (2)$

Multiply (1) by 2 and (2) by 3 to give

$6x + 4y = 34 \quad (3)$

$6x + 15y = 12 \quad (4)$

$(4) - (3)$ gives

$11y = -22$

$y = -2$

Substituting $y = -2$ into (2) gives

$2x + 5 \cdot (-2) = 4$

$2x - 10 = 4$

$2x = 14$

$x = 7$

Question 12, (4)

$$\frac{x^2 - 4x}{x^2 + x - 20}$$

$$= \frac{x(x-4)}{(x+5)(x-4)}$$

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

Question 13, (3)

$$\frac{4}{\sqrt{8}} = \frac{4}{\sqrt{8}} \, x \, \frac{\sqrt{8}}{\sqrt{8}}$$

$$= \frac{4\sqrt{8}}{8} = \frac{\sqrt{8}}{2} = \frac{2\sqrt{2}}{2} = \sqrt{2}$$

Question 14, (2)

$8^{\frac{5}{3}} = (8^{\frac{1}{3}})^5 = (\sqrt[3]{8})^5 = 2^5 = 32$

2015 National 5 Mathematics Paper 2

Click to jump to question:

Question 1, (3)

Value after two years $= £240,000\ x\ 1.028^2 = £253,628.16.$

Question 2, (2)

$f(x) = 3x + 2$

$f(a) = 3a + 2$

Since $f(a) = 23$ we have

$3a + 2 = 23$

$3a = 21$

$a = 7$

Question 3, (3)

Using the Cosine Rule gives

$c^2 = a^2 + b^2 - 2ab\cos C$

$(AB)^2 = 1.35^2 + 1.2^2 - 2\ x\ 1.2\ x\ 1.35\ x \cos 35$

$(AB)^2 = 0.613\ldots$

$AB = 0.78$

So, $AB = 0.78\ km.$

Question 4, (2)

$|\underline{u}| = \sqrt{6^2 + (-13)^2 + 18^2}$

$= \sqrt{529} = 23$

Question 5, (2)

$\underline{p} = \begin{pmatrix} -5 \\ 3 \end{pmatrix}, \underline{q} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$

$\underline{p} + \underline{q} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$

Question 6, (3) (2)

a) Volume of Sphere $= \frac{4}{3}\pi r^3$

Volume of the Earth $= \frac{4}{3}\pi \ x \ 6{,}400^3$

$= 1,098,066,219{,}443$

$= 1{,}100{,}000{,}000{,}000$

$= 1.1 \ x \ 10^{12}$.

b) $\frac{1.1 \ x \ 10^{12}}{2.2 \ x \ 10^{10}} = 0.5 \ x \ 10^2 = 0.5 \ x \ 100 = 50.$

So, 50 times.

Question 7, (3)

$$\frac{5t}{s} \div \frac{t}{2s^2}$$

$$= \frac{5t}{s} x \frac{2s^2}{t}$$

$$= \frac{10ts^2}{ts}$$

$$= 10s$$

Question 8, (3)

Since the price has been reduced by 15% James paid 85% of the original price.

£297.50 = 85%

$$1\% = \frac{£297.50}{85} = £3.50$$

$100\% = £3.50 \ x \ 100 = £350$

Question 9, (4)

Linear Scale Factor $= \frac{30}{24} = 1.25$

Area Scale Factor $= (1.25)^2 = 1.5625$

Area of $PSR = 1.5625 \ x \ 400 = 625 \ cm^2$

Area of $PSTQ = 625 - 400 = 225 \ cm^2$.

Question 10, (4)

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

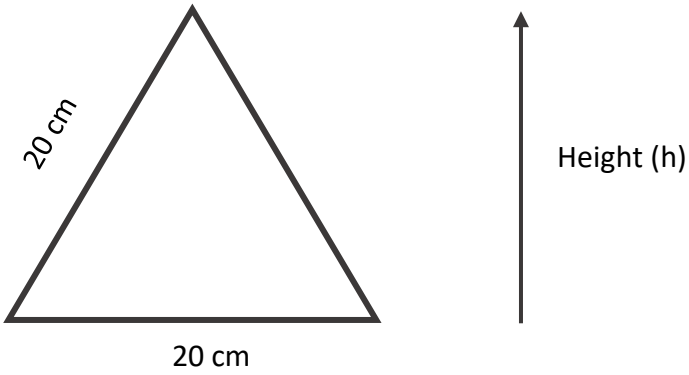
$28.4 = \frac{64}{360} x\ \pi\ x\ 2r$ since diameter = 2 x radius

$\frac{28.4\ x\ 360}{64\pi} = 2r$

$r = \frac{28.4\ x\ 360}{128\pi}$

$r = 25\ cm.$

Question 11, (4)



Using Pythagoras to calculate height gives

$20^2 = 10^2 + h^2$

$400 = 100 + h^2$

$300 = h^2$

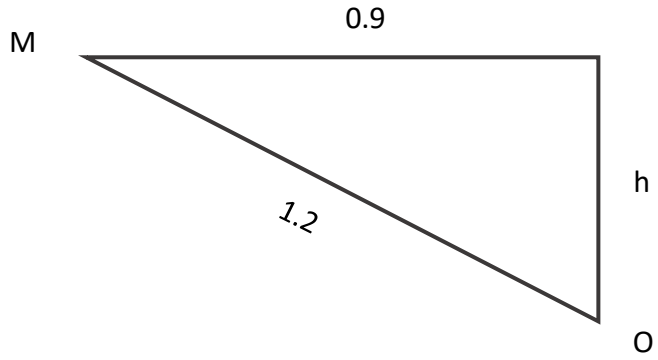
$h = \sqrt{300} = 17.32\ cm$

Area of triangle $= \frac{1}{2}\ x\ 17.32\ x\ 20 = 173.2\ cm^2.$

Area of table top $= 173.2\ x\ 6 = 1,039.2\ cm^2.$

Question 12, (4)

Construct a right triangle from the midpoint of ML with O & M.



Using Pythagoras gives

$1.2^2 = 0.9^2 + h^2$

Solving gives $h = 0.79\ m$

So, depth of milk $= 0.79 + radius = 0.79 + 1.2 = 2.78\ m.$

Question 13, (4)

$PQR = 180 - 128 = 56°$

$QRP = 180 - (52 + 72) = 56°$

Using the Sine Rule gives

$$\frac{q}{\sin Q} = \frac{r}{\sin R}$$

$$\frac{q}{\sin 52°} = \frac{25}{\sin 56°}$$

$$q = \frac{25 \sin 52°}{\sin 56°} = 23.67$$

So, distance is 23.67 km.

Question 14, (1) (2) (4)

a) i) Length $= 13 + 2x$

ii) Width $= 9 + 2x$

Area of card $= (13 + 2x)(9 + 2x) = 117 + 44x + 4x^2$

But since the area $= 270$ we have

$270 = 117 + 44x + 4x^2$

$0 = 4x^2 + 44x - 153$

b) $4x^2 + 44x - 153 = 0$

Using the quadratic formula with $a = 4, b = 44, c = -153$ gives

$$x = \frac{-44 \pm \sqrt{44^2 - 4 \text{ x } 4 \text{ x } (-153)}}{2x4}$$

$$x = \frac{-44 \pm \sqrt{4384}}{8}$$

$x = 2.7, x = -13.8$

Since x is a length it cannot be negative so $x = 2.7$

So, the width of the border is 2.7 cm.