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Question 1, (2)

$$\begin{aligned}6\frac{1}{5} - 2\frac{1}{3} &= \frac{31}{5} - \frac{7}{3} \\ &= \frac{93}{15} - \frac{35}{15} \\ &= \frac{93 - 35}{15} \\ &= \frac{58}{15}\end{aligned}$$

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

$$\text{So, } FDE = 180 - 90 - 64 = 26^\circ$$

ABO = 90° since tangent to the circle

$$\text{So, } OBD = 90 - 77 = 13^\circ$$

And $\angle BDO = 13^\circ$ since isosceles triangle

$$\text{So, } \angle BDF = 26 + 13 = 39^\circ$$

Question 4, (3)

$$\begin{aligned}(x - 4)(x^2 + x - 2) \\ &= x^3 + x^2 - 2x - 4x^2 - 4x + 8 \\ &= x^3 - 3x^2 - 6x + 8\end{aligned}$$

Question 5, (3)

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

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

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

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

$$a = 8$$

Question 6, (2)

Since the amplitude is 4, $a = 4$

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

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)

$$\cos 90^\circ = 0$$

$\cos 100^\circ < 0$ from inspection of the graph

$\cos 300^\circ > 0$ from inspection of the graph

So, $\cos 100^\circ < \cos 90^\circ < \cos 300^\circ$

Question 10, (3) (2)

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

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

$$Q_1 = 17, Q_3 = 26$$

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

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)

$$\begin{aligned} & \frac{x^2 - 4x}{x^2 + x - 20} \\ &= \frac{x(x - 4)}{(x + 5)(x - 4)} \\ &= \frac{x}{x + 5} \end{aligned}$$

Question 13, (3)

$$\begin{aligned}\frac{4}{\sqrt{8}} &= \frac{4}{\sqrt{8}} \times \frac{\sqrt{8}}{\sqrt{8}} \\ &= \frac{4\sqrt{8}}{8} \\ &= \frac{\sqrt{8}}{2} \\ &= \frac{2\sqrt{2}}{2} \\ &= \sqrt{2}\end{aligned}$$

Question 14, (2)

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

2015 National 5 Paper 2

Question 1, (3)

$$\text{Value after two years} = £240,000 \times 1.028^2 = £253,628.16$$

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

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

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

$$(AB)^2 = 0.613\dots$$

$$AB = 0.78$$

So, $AB = 0.78 \text{ km}$

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

$$\begin{aligned} \text{Volume of the Earth} &= \frac{4}{3}\pi \times 6,400^3 \\ &= 1,098,066,219,443 \\ &= 1,100,000,000,000 \\ &= 1.1 \times 10^{12} \end{aligned}$$

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

So, 50 times

Question 7, (3)

$$\begin{aligned} \frac{5t}{s} \div \frac{t}{2s^2} \\ &= \frac{5t}{s} \times \frac{2s^2}{t} \\ &= \frac{10ts^2}{ts} \\ &= 10s \end{aligned}$$

Question 8, (3)

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

$$£297.50 = 85\%$$

$$1\% = \frac{£297.50}{85} = £3.50$$

$$100\% = £3.50 \times 100 = £350$$

Question 9, (4)

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

$$\text{Area Scale Factor} = (1.25)^2 = 1.5625$$

$$\text{Area of } PSR = 1.5625 \times 400 = 625 \text{ cm}^2$$

$$\text{Area of } PSTQ = 625 - 400 = 225 \text{ cm}^2$$

Question 10, (4)

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

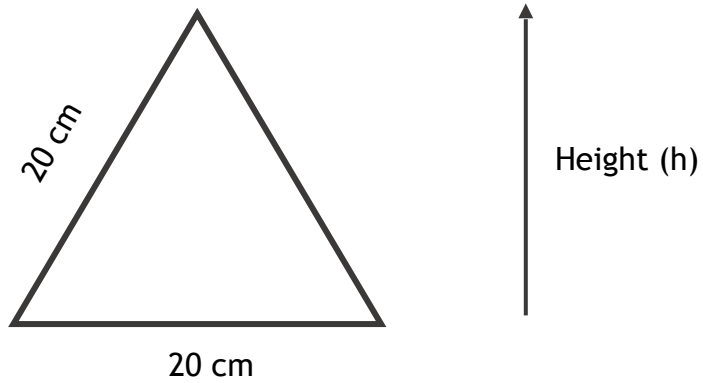
$$28.4 = \frac{64}{360} \times \pi \times 2r \quad \text{since diameter} = 2 \times \text{radius}$$

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

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

$$r = 25 \text{ cm}$$

Question 11, (4)



Using Pythagoras to calculate height gives

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

$$400 = 100 + h^2$$

$$300 = h^2$$

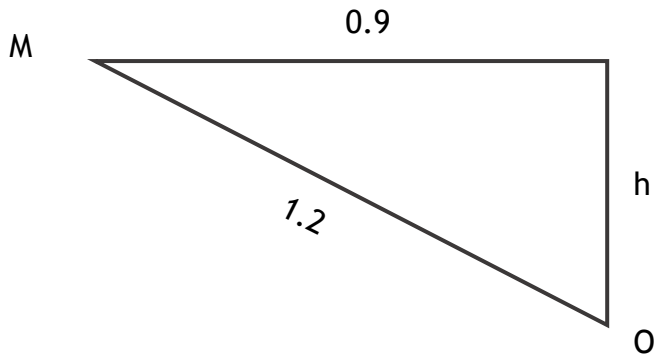
$$h = \sqrt{300} = 17.32 \text{ cm}$$

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

$$\text{Area of table top} = 173.2 \times 6 = 1,039.2 \text{ cm}^2$$

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 $h = 0.79 \text{ m}$

So, depth of milk = $0.79 + \text{radius} = 0.79 + 1.2 = 2.78 \text{ m}$

Question 13, (4)

$$PQR = 180 - 128 = 56^\circ$$

$$QRP = 180 - (52 + 72) = 56^\circ$$

Using the Sine Rule gives

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

$$\frac{q}{\sin 52^\circ} = \frac{25}{\sin 56^\circ}$$

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

So, distance is 23.67 km

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

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

ii) Width = $9 + 2x$

$$\begin{aligned}\text{Area of card} &= (13 + 2x)(9 + 2x) \\ &= 117 + 44x + 4x^2\end{aligned}$$

And since the area = 270 we have

$$\begin{aligned}270 &= 117 + 44x + 4x^2 \\ 0 &= 4x^2 + 44x - 153\end{aligned}$$

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

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

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

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

$$x = 2.7, x = -13.8$$

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

So, the width of the border is 2.7 cm