

EXERCISE BOOK

Name: Abdul Musthakin Class: _____
Topic: _____ Teacher: _____



UKMT SMC 2013

1) A ✓

$$\frac{1}{4} \cdot \frac{1}{5} = \frac{5}{20} - \frac{4}{20} \\ = \frac{1}{20}$$

2) C ✓

$$2013^2 - 2013 \\ = 2013[2013-1]$$

$$= 2013[2012] \quad t = t_1, d = \frac{1}{5} I$$

3) E ✗ D

$$\frac{1}{5} I + 6L = \frac{1}{5} I$$

4) C ✓

$$2013 - 2012 \\ 26 \\ 6L = \left[\frac{1}{6} - \frac{1}{5} \right] T \\ = \frac{1}{30} T$$

5) E ✓

$$\frac{30}{6} \\ I = 20KG \\ = 120$$

6) E ✓

$$(2) \cdot (3) \cdot (2 \cdot 7 \cdot 3) \\ = 315$$

$$\cdot (2 \cdot 7) \cdot (7 \cdot 5) \\ \cdot (2 \cdot 2 \cdot 5) \cdot (7 \cdot 4) \\ - \underline{\underline{xy + 2y = 60}}$$

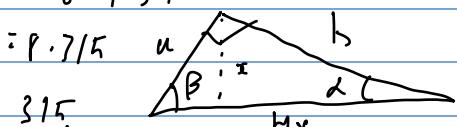
7) B ✓

$$xy + 2x = 100 \\ 2x - 2y = 40$$

8) B ✓

$$x - y = 70$$

9) A ✓



$$\frac{3}{2} \cdot \frac{4}{2} \cdot \frac{3}{2} \\ \text{Area} = \frac{1}{2} \cdot 4 \cdot 3 \\ = 6 \text{ cm}^2$$

$$23 \times 9$$

$$= 207 - 27$$

10) B ✓

$$= 207 \times$$

11) A ✓

$$29 \times 9 = 207 + 9$$

12) B ✓

$$\text{Area} = \frac{1}{2} ab \sin(C) \\ = 216 \quad /$$

13) C ✗ D

$$25^2 = \frac{1}{2} ab \sin(P) \\ 625 = ab \sin(P)$$

$$= 650 - 65 \times$$

14) D

$$66 \times 9 =$$

15) B ✓

$$660 - 66 \times$$

16) D ✓

$$76 \times 9 = \\ = 700 - 70 \times$$

$$y_x = \frac{y_{sc}}{\sin(90)} = \frac{a}{\sin \alpha} = \frac{b}{\sin \beta}$$

$$\frac{\sin \beta}{b} = \frac{1}{y_x}$$

$$\sin(\beta) = \frac{1}{y_x}$$

L

$$\sqrt{r^2 + h^2} = r$$

64 < 75 < 81

SLOUZ
SOLZO
SOLSI
SOLSH
SOSVU
SLSJO
SLSLZ

for L:

L ...

m LL ...

m .LL... A = S²

m ...LL...

mLL ... 0.7hA = 0.7hs²mLL ... 0.7hs² ≈ (0.4s)²

17) A ✓

18) C ✓

19) C ✓

20) E ✓

21) B ✓

22) F ✓

23) A

24) E

25) D

a:b

$$a+b : a-b \quad t = \frac{s}{d}$$

$$0.87^2$$

$$\frac{a}{b} = \frac{a+b}{a-b} \quad t = \frac{s}{d}$$

x 3 7 10 11 11

x 5 10 11 11

✓ 4 9 10 11 11

$$a(a-b) = b(a+b) \quad \frac{1}{3} = \frac{3}{d_1}$$

$$a^2 - ab = b^2 + ab \quad d_1 = 9 \text{ miles}$$

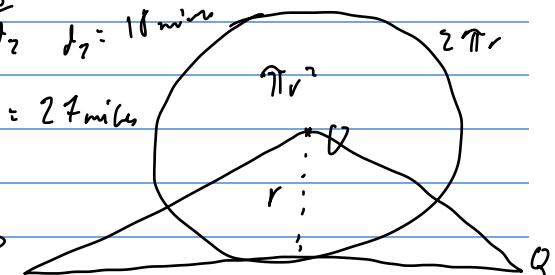
$$a^2 - b^2 = 2ab \quad \frac{1}{7} = \frac{b}{d_2} \quad d_2 = 16 \text{ miles}$$

$$4 + 4\sqrt{2} \cancel{\leq} 4 + 3\sqrt{2} \quad d_1 + d_2 = 27 \text{ miles}$$

$$1 + 2\sqrt{3} + 2 \cancel{\geq} 1 + 2\sqrt{2} \quad t = \frac{3}{27/1} + \frac{b}{27/1}$$

$$1 + 2\sqrt{3} + 7 \cdot 4 \quad d_1 + d_2 = 27 \text{ miles}$$

$$= 4 + 4\sqrt{3} = \frac{2}{27}[7+6] \quad P$$

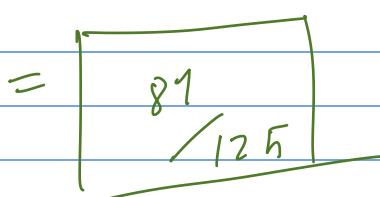


$$\text{Markj: } (16 \times 4) - 2 + 25 \quad \frac{7+2\sqrt{5}}{1+2\sqrt{3}+7-4} = \frac{2}{27} \cdot 9 = \frac{2}{3}$$

$$\text{Area} = \frac{1}{2} r \overline{PQ} = \pi r^2$$

$$= 64 + 23 \quad 2\sqrt{2} \cancel{\geq} \sqrt{5} - 1$$

$$\frac{1}{2} \overline{PQ} = \pi r \quad \overline{PQ} = 2\pi r$$



$$\frac{\sqrt{2}}{1} = \frac{\sqrt{2}+1}{\sqrt{2}-1}$$

$$\therefore (\sqrt{2}+1)^2 = \frac{x}{1} \quad \frac{x}{\sin(60^\circ)} = \frac{1}{\sin(90^\circ)}$$

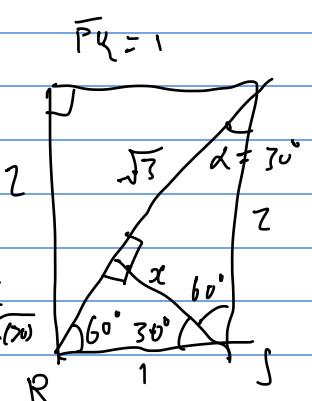
$$1 + \sqrt{2} = \frac{2 + \sqrt{2}}{\sqrt{2}} \quad x = \frac{\sqrt{2}}{2}$$

$$= 2 + \sqrt{2} \cdot \frac{\sqrt{2}}{2} = \frac{2 + 2}{2} = 2 \quad \frac{1}{2}$$

$$= \frac{2\sqrt{2}+2}{2} = \frac{\sqrt{2}+1}{1} = \frac{\sqrt{2}}{2}$$

$$2 : \frac{\sqrt{2}}{2} = 16 : \sqrt{2}$$

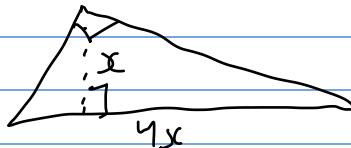
$$\cos \alpha = \frac{\sqrt{2}}{2} \quad \alpha = 30^\circ$$



$$\begin{aligned} 16^{-1} &= 15 \\ 64^{-1} &= 63 \\ 256^{-1} &= 255 \end{aligned}$$

$$4^n - 1 = 3, n=1$$

$$\begin{aligned} 10n+1 &= 10k_1 + 10k_2 + 2 && \text{prime} \\ 10[n - k_1 - k_2] &= 1 && \text{for } n > 1: \\ 4^n - 1 & \end{aligned}$$



$$\begin{aligned} 14 &\cancel{=} 8(2) + 2 \\ 37 &= 8(\cancel{2}) + 1 \end{aligned}$$

$$\begin{aligned} \text{Area} &\approx 2sc^2 \quad | \\ &= \frac{1}{2} ab \sin(90^\circ) \quad 85 = 8(\cancel{\frac{11}{8}}) + 7 \\ &= \frac{1}{2} ab \quad 91 = 8(\cancel{\frac{11}{8}}) + 7 \\ x^2 &= ab \quad 91 = 13 \cdot 7 \end{aligned}$$

$$\begin{aligned} y_x &= \frac{a}{\sin \alpha} = \frac{b}{\sin \beta} \quad 99 = 8(12 + 5) \\ &= \frac{a}{\sin \alpha} \quad 99 = 3 \cdot 3 \cdot 11 \\ a \sin(\beta) &= b \sin(\alpha) \end{aligned}$$

$$y_x^2 = b^2 - s^2$$

$$\begin{aligned} (y_x)^2 &= (b_c)^2 \\ (b_x)^2 \cdot p_x^2 &= y_x^2 \\ \sqrt{p_x^2} &= b_c \cdot \sqrt{2} \end{aligned}$$

Solutions

- 3) I should have gotten this question correct. I got 6, even though the step before that was summing 2 and 3, which is obviously 5. Therefore, the correct answer is D. If I spent a bit more time on the question, or revisited it, I think I would have been able to spot and correct my mistake.

The solution document provides an alternative method:

$$2013^2 - 2013 \equiv 13^2 - 13 \pmod{100}$$

$$13^2 - 13 \equiv 56 \pmod{100}$$

$$\Rightarrow 2013^2 - 2013 \equiv 56 \pmod{100}$$

∴ 'tens' digit is 5.

- 4) I got this question right. Additionally, the method I used to eliminate all of the incorrect answers is valid. However, I only showed what the answer could not have been, and not what it was - well, I did not prove it.

Let R be the number of items bought

Total cost = whole number of pounds plus $99R$ pence

→ whole number of pounds minus R pence

£65.76 spent → £66 - 24p OR £67 - 124p OR ...

$$\Rightarrow R \equiv 24p \pmod{100}$$

Since an item costs at least 99p, and £65.76 spent, 66 items must could have been bought
∴ $R = 24$; the answer is B.

- 12) The given method of solving this rather easy, but this does not mean that I would have been able to figure it out on my own. I need to get better at discrete maths.

Choice of three for first sweet

Choice of two for second sweet : it can't be the same as the first

Choice of two for third, fourth and fifth sweets

Combinations = $3 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 48$; the answer is B.

13) I got this question wrong because I used $t = \frac{d}{t}$ instead of $s = \frac{d}{t}$ for my calculations. If I used the correct formula, I would have obtained the correct answer.

Anya walks 20 minutes at 3 mph and runs for 20 minutes at 6 mph.
distance = $\frac{1}{3} h \times 3 \text{ mph} + \frac{1}{3} h \times 6 \text{ mph} = 3 \text{ miles}$

Bruce travels some distance.

walks $\frac{3}{2}$ miles at 3 mph and runs $\frac{3}{2}$ miles at 6 mph.

time $\frac{3}{2} \text{ miles} / 3 \text{ mph} + \frac{3}{2} \text{ miles} / 6 \text{ mph}$

= $\frac{1}{2} h + \frac{1}{4} h = \frac{3}{4} h = 45 \text{ minutes}$; the answer is D.

