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|---|---|---|
| عدد المسائل: خمس | مسابقة في مادة الرياضيات<br>المدة: ساعتان | الاسم:<br>الرقم: |

ارشادات عامة: - يسمح باستعمال آلة حاسبة غير قابلة للبرمجة أو اختزان المعلومات أو رسم البيانات.
- يستطيع المرشح الإجابة بالترتيب الذي يناسبه دون الإلتزام بترتيب المسائل الواردة في المسابقة.

**I- (4 points)**

In the table below, only one of the proposed answers to each question is correct.
Write down the number of the question and give, with justification, its corresponding answer.

| Nº | Questions | Answers a | Answers b | Answers c |
|---|---|---|---|---|
| 1) | $\left(\sqrt{3}+2\right)^2+\left(\sqrt{3}-2\right)^2=$ | 14 | 26 | $8\sqrt{3}$ |
| 2) | $\dfrac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}=$ | $1-\dfrac{\sqrt{3}}{\sqrt{2}}$ | $3+\sqrt{6}$ | $3-\sqrt{6}$ |
| 3) | If the following table is a table of proportionality, then x = <br> $\begin{array}{|c|c|}\hline \frac{1}{2} & x \\ \hline \frac{5}{2} & 10 \\ \hline \end{array}$ | 1 | 2 | 5 |
| 4) | The original price of a pants is 100 000 LL. After an increase of 10 %, followed by a decrease of 10 %, the final price of this pants is: | 99 000 LL | 100 000 LL | 101 000 LL |

**II- (4 points)**

Given $A(x)=2(x-3)(x-1)$ and $B(x)=x^2-9$.

1) Show that $A(x)=2x^2-8x+6$, then solve the equation $A(x)=6$.

2) a. Factorize $B(x)$.

   b. Solve the equation $B(x)=0$.

3) Given $F(x)=\dfrac{2(x-3)(x-1)}{(x-3)(x+3)}$.

   a. For what values of $x$, $F(x)$ is defined?

   b. Simplify $F(x)$.

   c. Does the equation $F(x)=2$ have a solution? Justify.

**III- (1.5 points)**

The number of students of class A is 35 and that of class B is 25.

- 40 % of students of class A practice basketball.
- 10 students of class B practice basketball.

1) Verify that the number of students in class A who practice basketball is 14.
2) The students of the two classes A and B meet in the same court.
   Calculate the number and the percentage of students who practice basketball in this court.

**IV- (6 points)**

In an orthonormal system of axes $(x'Ox, y'Oy)$, consider the points A (2 ; 0), B (0 ; 4) and E (- 4 ; 0).

Let (d) be the line with equation $y = -2x + 4$.

1) Plot the points A, B and E.
2) Verify that A and B are two points on (d), then draw (d).
3) Let $(d')$ be the line passing through E and perpendicular to (d).

   Verify that $y = \frac{1}{2}x + 2$ is the equation of $(d')$.

4) The line $(d')$ intersects $(y'Oy)$ at H (0 ; 2) and intersects (d) at F.

   a. Verify that the coordinates of F are $\left(\frac{4}{5};\frac{12}{5}\right)$.

   b. Show that H is the orthocenter of triangle EAB.

   c. Prove that (AH) is perpendicular to (EB).

5) The line (AH) intersects (EB) at G.

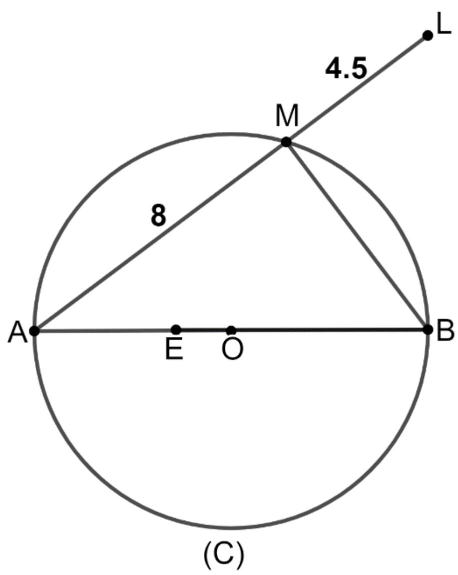
   a. Prove that the four points E, G, F and A are on the same circle (C) with diameter to be determined.

   b. Calculate the radius of (C).

**V- (4.5 points)**

In the adjacent figure :

- (C) is a circle with center O
- [AB] is a diameter of (C) so that $AB = 10$
- M is a point on (C) so that $AM = 8$
- L is the point on (AM) so that $ML = 4.5$
- E is the point on [AB] so that $BE = 6.4$.




1) Draw the figure.
2) a. Calculate $MB$, then show that $BL = 7.5$.

   b. Deduce that $(BL)$ is tangent to the circle (C).

3) The parallel through E to $(AL)$ intersects $(BL)$ at F.

   Use Thales' theorem to prove that $BF = 4.8$.

4) a. Calculate the ratio $\frac{LF}{LB}$.

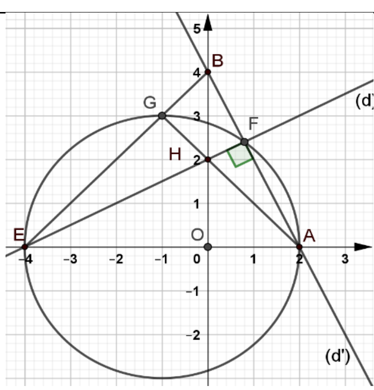
   b. Deduce that $(MF)$ is parallel to $(AB)$.

وزارة التربية والتعليم العالي
المديرية العامة للتربية

الشهادة المتوسطة

دورة العام ٢٠٢٢ العادية
السبت ٢٥ تموز ٢٠٢٢

مشروع أسس التصحيح

<table>
<tr><th>Parts of questions</th><th colspan="2">Question I</th><th>Mark</th></tr>
<tr><td>1</td><td>$(\sqrt{3}+2)^2+(\sqrt{3}-2)^2=3+4\sqrt{3}+4+3-4\sqrt{3}+4=14$ (a)</td><td>0.5 + 0.5</td><td>1</td></tr>
<tr><td>2</td><td>$\frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}=\frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}\times\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}}=3+\sqrt{6}$ (b)</td><td>0.5 + 0.5</td><td>1</td></tr>
<tr><td>3</td><td>$5x=10$ then $x=2$ (b)</td><td>0.5 + 0.5</td><td>1</td></tr>
<tr><td>4</td><td>$100\,000\times1.1\times0.9=99\,000$ LL (a)</td><td>0.25 + 0.25 + 0.5</td><td>1</td></tr>
<tr><td></td><td colspan="2">Question II</td><td></td></tr>
<tr><td>1</td><td>$A(x)=2(x-3)(x-1)$<br>$A(x)=2(x^2-3x-x+3)$<br>$A(x)=2(x^2-4x+3)$<br>$A(x)=2x^2-8x+6$<br>------------------------------------------------<br>$A(x)=6$<br>$2x^2-8x=0$<br>$2x(x-4)=0$<br>$x=0$ or $x=4$</td><td><br>0.25<br>0.25<br>0.25<br><br><br>0.25<br>0.25<br>0.25</td><td>0.75<br><br>0.75</td></tr>
<tr><td>2a</td><td>$B(x)=(x+3)(x-3)$</td><td></td><td>0.5</td></tr>
<tr><td>2b</td><td>$B(x)=0$ then : $x=-3$ or $x=3$</td><td>0.25 + 0.25</td><td>0.5</td></tr>
<tr><td>3a</td><td>$F(x)=\frac{2(x-3)(x-1)}{(x-3)(x+3)}$<br>$F(x)$ is defined for: $(x+3)(x-3)\neq0$ then: $x\neq-3$ and $x\neq3$</td><td><br>0.25 + 0.25</td><td>0.5</td></tr>
<tr><td>3b</td><td>$F(x)=\frac{2(x-1)}{x+3}$.</td><td></td><td>0.5</td></tr>
<tr><td>3c</td><td>$\frac{2(x-1)}{x+3}=2$ then:<br>$2x-2=2x+6$<br>$0x=8$ No solution</td><td><br>0.25<br>0.25</td><td>0.5</td></tr>
<tr><td colspan="4">Question III</td></tr>
<tr><td>1</td><td>$\frac{40}{100}\times35=14$ students of class A practice basketball.</td><td></td><td>0.75</td></tr>
<tr><td>2</td><td>$14+10=24$ is the number of students who practice basketball in the court.<br><table><tr><td>100</td><td>60</td></tr><tr><td>$x$</td><td>24</td></tr></table>$x=\frac{24\times100}{60}=40$. Then 40 % of the students practice basketball in the court.</td><td></td><td>0.25<br><br>0.5</td></tr>
<tr><td></td><td colspan="2">Question IV</td><td></td></tr>
<tr><td>1</td><td></td><td>0.25 + 0.25 + 0.25</td><td>0.75</td></tr>
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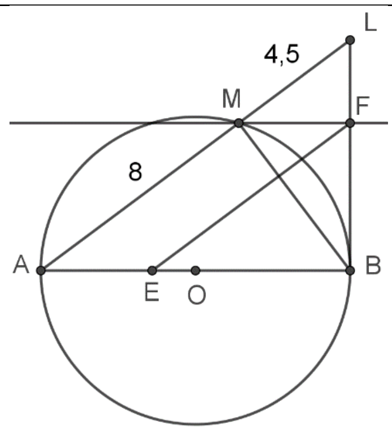
| | | |
|---|---|---|
| **2** | $y_A = -2x_A + 4$<br>$y_B = -2x_B + 4$<br>Then A and B are two points on (d).<br>Draw (d). | **0.5**<br>**0.25**<br><br>**0.25** |
| **3** | Slope of (d’) : $a \times -2 = -1$ ; $a = \frac{1}{2}$ then $y = \frac{1}{2}x + b$<br>(d’) passes through E so $y_E = \frac{1}{2}x_E + b$ ; b = 2<br>(d’): $y = \frac{1}{2}x + 2$. | **0.75**<br><br>**0.5** |
| **4a** | (d) passes through F and (d’) passes through F or y = y. **0.5 + 0.25** | **0. 75** |
| **4b** | H is the point of intersection of the two heights [OB] and [EF]. **0.25 + 0.25** | **0.5** |
| **4c** | (AH) is the third height or the product of slopes $= -1$. | **0.5** |
| **5a** | The two triangles AGE and AEF are right of common hypotenuse [AE], so the four points are on the same circle of diameter [AE]. **0.25 + 0.25 + 0.25** | **0.5**<br>**0.25** |
| **5b** | Radius $= \frac{AE}{2} = 3$. | **0.5** |
| | **Question V** | |
| **1** |  | **0.5** |
| **2a** | $MB^2 = 100 - 64 = 36$ *then* $MB = \sqrt{36} = 6$ (Pythagoras theorem).<br>BL = 7.5 (Pythagoras theorem). | **0.5**<br>**0.5** |
| **2b** | $BL^2 = MB^2 + ML^2$ (converse of Pythagoras theorem).<br>Then ABL is right at B.<br>So (BL) ⊥ (AB).<br>Then (BL) is tangent to circle (C) at B. | **0.5**<br><br>**0.25** |
| **3** | Applying Thales’s theorem:<br>$\frac{BE}{BA} = \frac{BF}{BL}$ **0.5**<br>$\frac{6.4}{10} = \frac{BF}{7.5}$ then BF = 4.8 **0.25 + 0.25** | **1** |
| **4a** | $\frac{LF}{LB} = \frac{2.7}{7.5} = 0.36$ | **0.5** |
| **4b** | $\frac{LM}{LA} = \frac{4.5}{12.5} = 0.36$ then $\frac{LF}{LB} = \frac{LM}{LA} = 0.36$ **0.25 + 0.25**<br>Thus (MF) is parallel to (AB) (converse of Thales’s theorem). **0.25** | **0.75** |