

ARM JZT*
ECB RDG
LMD AHP
RAS JGD
DOB SJB

YEAR 10
5.3 MATHEMATICS
ASSESSMENT TASK 1
2022

Friday 11th March 2022

Period 2 or Period 4

Total Time: 55 min

260 copies

Surds, Indices &
Algebra
Interest & Depreciation

INSTRUCTIONS TO STUDENTS:

- Write ALL answers in the spaces provided.
- ALL NECESSARY working for each question must be shown to gain full marks.
- Marks may not be awarded for careless or badly arranged working.
- Diagrams are NOT NECESSARILY TO SCALE.
- Board-approved non-programmable calculators may be used.

Part A: Surds	/16
Part B: Indices & Algebra	/26
Part C: Interest & Depreciation	/15
Part D: Working Mathematically	/11
TOTAL	/68

Part A: Surds

(16 Marks)

1. Express the following in simplest form:

a) $\sqrt{20} + \sqrt{45}$ 2

b) $6\sqrt{3} \div 2\sqrt{15}$ 2

2. Expand and simplify the following

a) $2(6\sqrt{2} + \sqrt{3})$ 1

b) $(3 + 2\sqrt{16})(5 - 4\sqrt{3})$ 2

3. Find rational numbers a and b such that $2\sqrt{3} \times 5\sqrt{12} - 3\sqrt{24} = a + b\sqrt{6}$. 2

4. Express with a rational denominator:

a) $\frac{3}{2\sqrt{2}}$

1

b) $\frac{\sqrt{2}-1}{1+\sqrt{2}}$

2

5. If $m = \sqrt{3}$ and $n = \sqrt{18}$, evaluate the following, giving your answer in simplest surd form.

i. mn

1

ii. $\frac{n}{m}$

1

iii. $(m+n)^2$

2

Part B: Indices & Algebra

(26 Marks)

6. Fully simplify the following using index laws:

a) $2x^3y^2 \times -3x^4y^3$

2

b) $(16x^4)^{\frac{1}{2}}$

2

c) $\left(\frac{2x}{5}\right)^{-3}$

2

d) $\frac{x^{-1}y^5}{x^{-6}y^{-4}}$

2

7. Fully simplify:

a) $\frac{9x}{4y} \div \frac{5xy}{12}$

2

b) $\frac{5}{2r} + \frac{7}{6r}$

2

c) $\frac{x-2}{4} - \frac{x+1}{6}$

3

8. Expand and simplify the following expressions:

a) $4x - (2x - 3)$

1

b) $3(x^2 + 3) - 5(2x - 1)$

2

9. Fully factorise:

a) $x(5 + 3x) - 2(5 + 3x)$

1

b) $24x^4y^3 - 8x^3y^2$

2

10. Using $(ab)^y = a^yb^y$, write $15^y \times 45^y$ in simple index form, using bases of 3 and 5 only. 2

11. Use algebra to express $0.1\dot{4}\dot{8}$ as a simplified fraction. 3

Part C: Interest & Depreciation

(15 Marks)

12. \$58,000 is invested for 3 years at 9% p.a. interest, compounding yearly.
Calculate the amount of interest earned during that time.

2

13. \$780 is invested for 600 days at 1.75% p.a. simple interest.
How much interest will it have earned over this time?

2

14. Jim's mowing bought 5 lawnmowers 6 years ago. They cost \$352 each.
Since then they depreciated at a rate of 10% per year.

i. How much will the 5 lawnmowers be worth now, in total?

2

ii. How much (in total) will all of the lawnmowers have depreciated during that time? 1

15. A set of outdoor furniture sells for \$3850. Andy decides to buy it on terms. He pays a 20% deposit and then fortnightly instalments of \$77 for 2 years. Calculate:
- i. The amount of the deposit 1
 - ii. The interest charged 2
 - iii. The equivalent annual flat rate of interest. 2
16. Bonnie and Clyde each have \$12 000 to invest for 5 years.
Bonnie chooses to invest her money at 8% p.a. simple interest.
Clyde decides to invest his money at 5% p.a. compound interest, compounded quarterly.
- Who will end up with more money at the end of the investment? 3
- Show all calculations to justify your answer.

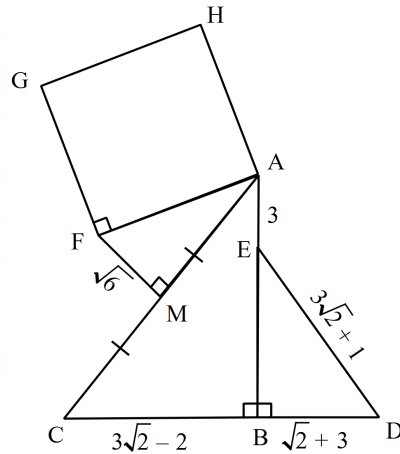
Part D: Working Mathematically (11 Marks)

17. If a and b are rational numbers, express $\frac{1}{4-\sqrt{3}}$ in the form $a + \sqrt{b}$ and give the values for a and b . 3

18. Fully simplify $3^{x+1} - 3^{x-2}$. 2

19. Find the amount (P) which you need to invest for 3 years at 4.5% p.a., compounded annually, in order to earn interest of \$1350. 3

20. In the diagram below, M is the midpoint of AC.
All the triangles are right-angled and AFGH is a square.
 $AE = 3$, $FM = \sqrt{6}$, $DE = 3\sqrt{2} + 1$, $BD = \sqrt{2} + 3$ and $BC = 3\sqrt{2} - 2$
Calculate the area of AFGH, clearly showing all surd expansions.



End of Paper

$$1a) \sqrt{4 \times 5} + \sqrt{9 \times 5} = 2\sqrt{5} + 3\sqrt{5} = 5\sqrt{5}$$

$$b) \frac{\sqrt[3]{6\sqrt{5}}}{2\sqrt{5}} = \frac{3}{\sqrt{5}} \quad (\text{or } \frac{3\sqrt{5}}{5})$$

$$2a) 12\sqrt{2} + 2\sqrt{3}$$

$$b) (3 + 2 \times 4)(5 - 4\sqrt{3}) = 11(5 - 4\sqrt{3}) = 55 - 44\sqrt{3}$$

$$3. 10\sqrt{36} - 3\sqrt{4 \times 6} = 10 \times 6 - 3 \times 2\sqrt{6} = 60 - 6\sqrt{6}$$

$$\therefore a = 60, b = -6$$

$$4a) \frac{3}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{2}}{2 \times 2} = \frac{3\sqrt{2}}{4}$$

$$b) \frac{\sqrt{2}-1}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}} = \frac{\sqrt{2}-2-1+\sqrt{2}}{1-2} = \frac{2\sqrt{2}-3}{-1} = 3-2\sqrt{2}$$

$$5. i) \sqrt{3} \times \sqrt{18} = \sqrt{54} = 3\sqrt{6}$$

$$ii) \frac{\sqrt{18}}{\sqrt{3}} = \sqrt{6}$$

$$iii) (\sqrt{3} + \sqrt{18})^2 = 3 + 2 \times \sqrt{3} \times 3\sqrt{2} + 18 = 21 + 6\sqrt{6}$$

$$6. a) -6x^7y^5$$

$$b) \sqrt{16} \times x^{4 \times \frac{1}{2}} = 4x^2$$

$$c) \left(\frac{5}{2x}\right)^3 = \frac{125}{8x^3}$$

$$d) x^{-1} \times x^6 \times y^5 \times y^4 = x^5y^9$$

$$7. a) \frac{9x}{4y} \times \frac{12y}{5x} = \frac{27}{5y^2}$$

$$b) \frac{15}{6r} + \frac{7}{6r} = \frac{22}{6r} = \frac{11}{3r}$$

$$c) \frac{3(x-2) - 2(x+1)}{12} = \frac{3x - 6 - 2x - 2}{12} = \frac{x-8}{12}$$

$$8. a) 4x - 2x + 3 = 2x + 3$$

$$b) 3x^2 + 9 - 10x + 5 = 3x^2 - 10x + 14$$

$$9. a) (5+3x)(x-2)$$

$$b) 8x^3y^2(3xy-1)$$

$$10. (3 \times 5)^3 \times (3^2 \times 5)^3 = 3^3 \times 5^3 \times 3^6 \times 5^6 = 3^9 \times 5^9$$

$$\begin{aligned}
 11. \quad x &= 0.1484848\ldots \\
 10x &= 1.484848\ldots \\
 1000x &= 148.484848\ldots \\
 1000x - 10x &= 148.48\ldots - 1.48\ldots
 \end{aligned}$$

$$990x = 147$$

$$x = \frac{147}{990}$$

$$= \frac{49}{330}$$

$$\begin{aligned}
 12. \quad A &= 58000(1+0.09)^3 \\
 &= 75111.68
 \end{aligned}$$

$$\begin{aligned}
 I &= 75111.68 - 58000 \\
 &= \$17111.68
 \end{aligned}$$

$$\begin{aligned}
 13. \quad I &= 780 \times 0.0175 \times \frac{600}{365} \\
 &= \$22.44
 \end{aligned}$$

$$\begin{aligned}
 14. i) \quad 5 \times 352 &= \$1760 \\
 A &= 1760(1-0.1)^6 \\
 &= \$935.34
 \end{aligned}$$

$$ii) 1760 - 935.34 = \$824.66$$

$$15. i) 3850 \times 0.2 = \$770$$

$$ii) 77 \times 26 \times 2 = 4004$$

$$4004 + 770 - 3850 = \$924$$

$$iii) 924 = (3870 - 770) \times R \times 2$$

$$924 = 3080 \times R \times 2$$

$$R = \frac{924}{6160}$$

$$= 0.15 \text{ or } 15\% \text{ pa.}$$

16. Bonnie:

$$I = 12000 \times 0.08 \times 5$$

$$= 4800$$

$$A = 12000 + 4800 = \$16800$$

Clyde:

$$A = 12000 \left(1 + \frac{0.05}{4}\right)^{5 \times 4}$$

$$= \$15384.45$$

\therefore Bonny has more

$$17. \frac{1}{4-\sqrt{3}} \times \frac{4+\sqrt{3}}{4+\sqrt{3}} = \frac{4+\sqrt{3}}{4^2-3}$$

$$= \frac{4}{13} + \frac{\sqrt{3}}{13}$$

$$= \frac{4}{13} + \frac{\sqrt{3}}{\sqrt{169}}$$

$$= \frac{4}{13} + \sqrt{\frac{3}{169}}$$

$$\therefore a = \frac{4}{13}, b = \frac{3}{169}$$

$$18. 3^{x-2+3} - 3^{x-2}$$

$$= 3^{x-2}(3^3 - 1)$$

$$= 3^{x-2}(26)$$

$$19. 1350 = P(1+0.045)^3 - P$$

$$1350 = P(1.045^3 - 1)$$

$$P = \frac{1350}{1.045^3 - 1}$$

$$= \$9563.20$$

$$20. EB^2 = (3\sqrt{2}+1)^2 - (\sqrt{2}+3)^2$$

$$= 18 + 6\sqrt{2} + 1 - (2 + 6\sqrt{2} + 9)$$

$$= 19 + 6\sqrt{2} - 11 - 6\sqrt{2}$$

$$= 8$$

$$EB = \sqrt{8} = 2\sqrt{2}$$

$$AB = 3 + 2\sqrt{2}$$

$$AC^2 = (3+2\sqrt{2})^2 + (3\sqrt{2}-2)^2$$

$$= 9 + 12\sqrt{2} + 8 + 18 - 12\sqrt{2} + 4$$

$$= 39$$

$$AC = \sqrt{39}$$

$$AM = \frac{\sqrt{39}}{2}$$

$$\text{area } AFGH$$

$$= AF^2$$

$$= \left(\frac{\sqrt{39}}{2}\right)^2 + (\sqrt{6})^2$$

$$= \frac{39}{4} + 6$$

$$= \frac{63}{4}$$