



DXC* LMD
JAI ARP
AYG RAS
GPF/WMD JGD
RJW

YEAR 10

WEDNESDAY 12TH MAY
1:30PM
TERM 2, 2021

5.3 MATHEMATICS

TOTAL TIME: 90 MINUTES

Semester 1 Examination

245 COPIES

INSTRUCTIONS TO STUDENTS:

Write your name and teacher's initials on the TOP of EVERY marked SHEET of PAPER.

Attempt ALL questions.

Show ALL necessary working.

Calculators can be used throughout the examination.

Marks may not be awarded for careless or badly arranged work.

Diagrams are NOT drawn to scale.

Write your answers in the spaces provided on the paper.

A formula sheet is provided on page 2 for use throughout the examination. Detach this sheet.

This examination consists of SIX parts.

PART A: COMMON	(42 marks)
PART B: SURDS & INDICES	(13 marks)
PART C: INTEREST & DEPRECIATION	(8 marks)
PART D: GRAPHS	(15 marks)
PART E: QUADRATIC EQUATIONS & PARABOLAS	(26 marks)
PART F: MIXED QUESTIONS	(9 marks)
TOTAL	113 Marks

FORMULA SHEET

Pythagoras' Theorem

$$c^2 = a^2 + b^2$$

Simple interest

$$I = Prn$$

Compound interest

$$A = P(1 + r)^n$$

Depreciation

$$A = P(1 - r)^n$$

Solution of a quadratic equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Student's Name:

Teacher's Initials:

PART A: COMMON (42 Marks)

	Marks
1. Find 5% of \$600.	1
2. Simplify $7ab - 3a + 4ab$	1
3. Simplify $y^3 \times y^2 \times y^4$	1
4. Evaluate $5z^0$	1
5. Daniel purchased a ticket to go to an escape room. The ticket normally costs \$40 but he used a voucher to get a \$25 discount off the marked price. Calculate the percentage discount that was obtained.	2

6. Expand and simplify fully:

a) $4(2x + 7)$	1
b) $3y + 5(1 - 2y)$	2
c) $6(x - 1) - 2(x + 5)$	3
7. Factorise fully:	
a) $3a - 27b$	1
b) $18pq^2 - 12pq + 24q^2$	2
8. Simplify fully where possible, expressing your answers in positive index form:	
a) $12m^{-2}$	1
b) $2r^2t^{-3} \times 3r^{-3}t^2$	2

Student's Name:

Teacher's Initials:

9. If $d = -3$, $e = 4$ and $f = 6$, evaluate $f^2 + 2(e - d)$. 2

10. Simplify $(-6p^4q^3)^2$ 2

11. Solve for x :
a) $2x - 3 = 11$ 1

b) $4x - 7 = 3 - x$ 2

c) $\frac{x+1}{2} = \frac{x+4}{3}$ 3

12. A sailing boat costs \$25 000. Jess agrees to pay a 15% deposit and 60 equal monthly repayments to pay off the loan.

i) Calculate the deposit that Jess will pay. 1

ii) The total cost of the repayment plan, including the deposit, is \$50 070.
Calculate the amount of each monthly repayment. 2

iii) How much interest will Jess pay? 1

13. Adam invests \$9500 for 4 years at an interest rate of 2.4% p.a. compounding annually.

i) Calculate the value of the investment at the end of 4 years. 2

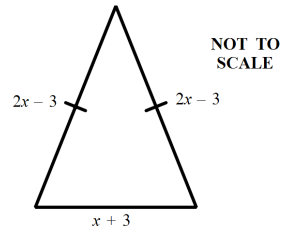
ii) Calculate the amount of interest that Adam received. 1

Student's Name:

Teacher's Initials:

14. The perimeter of the following isosceles triangle is 32 cm.

3



Find the value of x .

-
15. Find the value of m in the following equation:

2

$$\frac{2^{m+6}}{2^{2-m}} = 1$$

16. Lauren was born on February 29th in a leap year.

2

Therefore, she often celebrates her birthday on March 1st.

She only has a birthday **party** every leap year (which happens every 4 years), since this is on her actual birthday.

At her last birthday party, her grandmother was 5 times Lauren's age at that time.

At her next birthday party, her grandmother will be 4 times Lauren's age.

How old will Lauren be at her next birthday party?

End of Part A

Student's Name:

Teacher's Initials:

PART B: SURDS & INDICES (13 Marks)

Marks

Question 1

Fully simplify, leaving your answers in simplest surd form

(a) $\sqrt{75}$ 1

(b) $(7\sqrt{3})^2$ 1

(c) $\sqrt{24} + \sqrt{96} - \sqrt{54}$ 2

(d) $(2 - \sqrt{5})(4 + \sqrt{5})$ 2

Question 2

Expand & Simplify: $(5\sqrt{2} - \sqrt{3})(5\sqrt{2} + \sqrt{3})$ 2

Part B: Surds & Indices (continued)

Question 3

Simplify the expression, giving your answer with a rational denominator.

3

$$\frac{2}{\sqrt{2}+3} - \frac{6}{7}$$

Question 4

Bits are the unit of measurement for data.

2

1 Byte is 8 bits.

1 Kilobyte is 1024 bytes.

1 Megabyte is 1024 kilobytes.

1 Gigabyte is 1024 megabytes.

Calculate how many bits are in 16 gigabytes. Express your answer as a power of 2.

End of PART B

Student's Name:

Teacher's Initials:

PART C: INTEREST & DEPRECIATION (8 marks)

Marks

Question 5

Claire takes a loan of \$2400 with a simple interest rate of 12% p.a. to be paid over 8 months.

2

How much does she owe for the loan in total?

Question 6

Isaac's car depreciates at a rate of 20% p.a. The current value of the car is \$10 035.20 and the car was purchased 4 years ago.

3

Calculate the amount of depreciation that had occurred from the time of purchase until now.

Question 7

Jackson is choosing between two options for the best way to invest \$4000 over 4 years.

3

- Bank A offers a simple interest account at 19% p.a.
- Bank B offers a compound interest account at 14.4% p.a., compounding monthly.

Which bank offers the better deal? Justify your answer with working.

End of PART C

PART D: GRAPHS (15 marks)

Marks

Question 8

Consider the graph $y = 2^x - 4$

(i) What type of curve is this?

1

(ii) Find the x-intercept and the y-intercept.

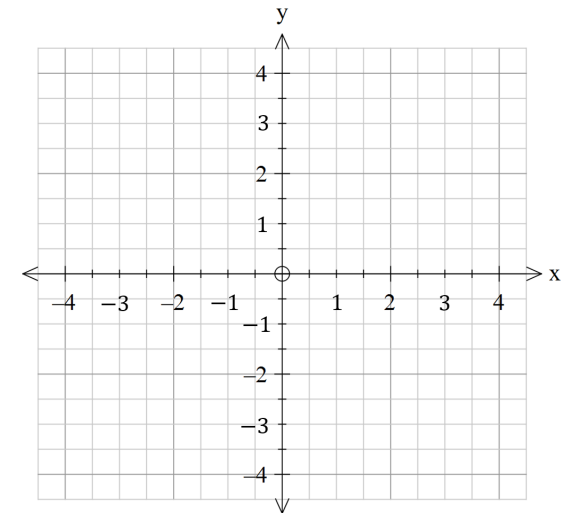
2

(iii) State the equation of the asymptote.

1

(iv) Graph the equation $y = 2^x - 4$ showing all important features.

2



Student's Name:

Teacher's Initials:

Part D: Graphs (continued)

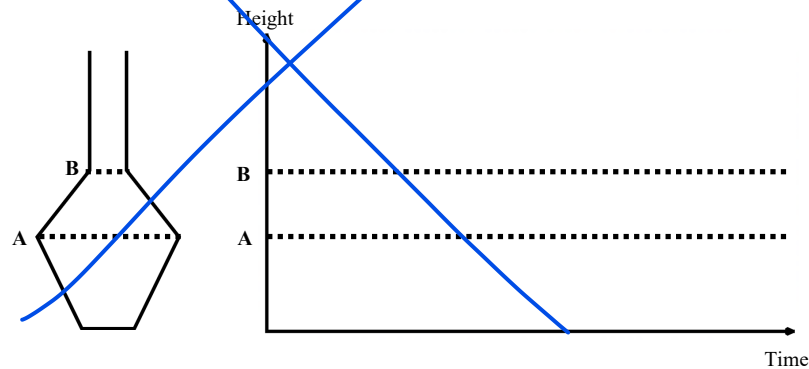
Question 9

The vase below is filled with water at a constant rate until it is completely full.

2

Draw a graph that models the height of the water in the vase over time.

(Use the heights marked A and B as a guide for your graph.)



Question 10

Ohm's law states that the voltage in a circuit varies directly as the current that passes through the circuit.

In a particular circuit, the voltage is 60 volts when the current is 4 amperes.

(i) Find the constant of proportionality (k).

1

(ii) Hence, find the current if the voltage is 24 volts.

1

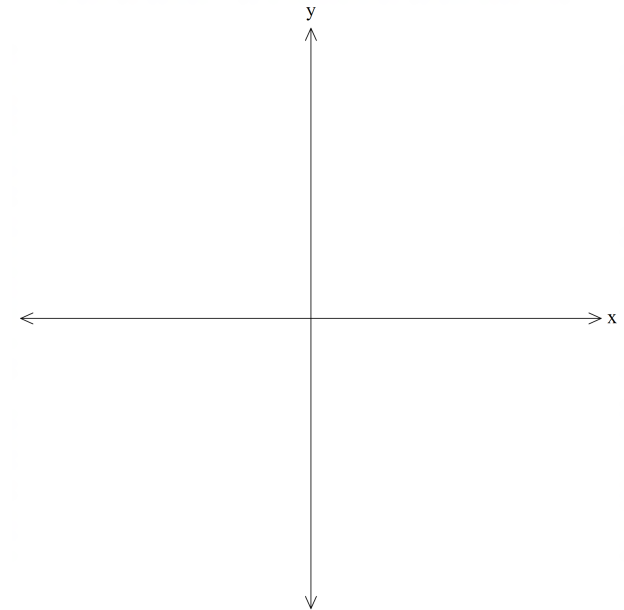
Part D: Graphs (continued)

Question 11

A hyperbola has asymptotes of $y = 2$ and $x = -1$ and passes through the origin.

(i) Sketch the graph of the hyperbola on the number plane below

2



(ii) The equation of the hyperbola is in the form $y = \frac{k}{x-a} + b$.
Find the values of a , b and k for the hyperbola.

3

End of PART D

Student's Name:

Teacher's Initials:

PART E: Quadratic Equations & Parabolas (26 marks)

Marks

Question 12

Solve for x :

(a) $4x^2 - 36 = 0$ **2**

(b) $(5x - 3)(2x + 1) = 0$ **2**

(c) $x^2 + 7x - 18 = 0$ **2**

Question 13

Use the **completing the square** method to solve $x^2 - 12x - 1 = 0$
Give your answers in surd form.

3

Part E: Quadratic Equations & Parabolas (continued)

Question 14

Use the **quadratic formula** to solve $11 - 6x - 4x^2 = 10$
Give your answers in simplest surd form.

3

Question 15

Form a quadratic equation that **has no real solutions**.

2

Briefly explain **why** your quadratic equation has no real solutions.

Student's Name:

Teacher's Initials:

Part E: Quadratic Equations & Parabolas (continued)

Question 16

For the parabola $y = 2x^2 - x - 10$

(i) Find the x -intercepts.

2

(ii) Find the y -intercept.

1

(iii) Find the equation of the axis of symmetry.

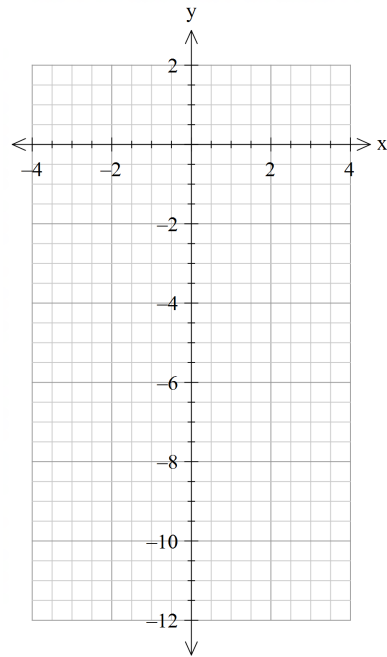
1

(iv) Find the co-ordinates of the vertex.

2

(v) Graph the parabola on this number plane, showing all the above features

2



Part E: Quadratic Equations & Parabolas (continued)

Question 17

A rectangular piece of paper has its length 2cm longer than its width.

If the length and width of this piece of paper are both reduced by 2cm each, the resulting area will be half of its original area.

(i) Set up a quadratic equation that satisfies the above scenario.

2

(ii) Solve the quadratic equation and find the original dimensions of the piece of paper.

2

End of PART E

Student's Name:

Teacher's Initials:

Question 19

Given that $\sqrt[3]{3^n} = 0.1$, evaluate 9^{-n} .

3

PART F: MIXED QUESTIONS (9 marks)

Marks

Question 18

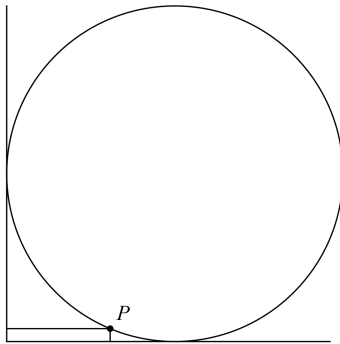
A cylindrical drum is placed on the ground and rolled against a wall as shown in the diagram.

3

The point P is on the rim of the drum and is touching the edge of a kerb protruding from the wall.

The kerb protrudes 40cm from the wall and is raised 5cm from the ground.

Calculate the radius of the drum.



NOT TO
SCALE

Question 20

\$10 000 is invested into a savings account that compounds annually with the following features:

3

- For the first year, the savings account has an interest rate of $r\%$ p.a.
- For the next year, the savings account has an interest rate of $(r + 2)\%$ p.a.

At the end of 2 years, the value of the account is \$12099.

Find the value of r .

END OF PAPER

PART A

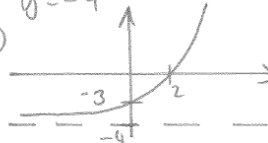
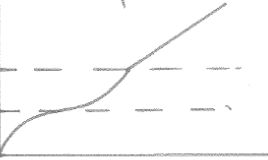
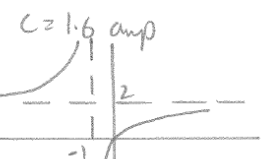
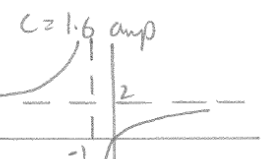
1. \$30
2. $11ab - 3a$
3. y^9
4. $\frac{5}{5}$
5. $\frac{25}{40} \times 100 = 62.5\%$
6. a) $8x + 28$
b) $5 - 7y$
c) $6x - 6 - 2x - 10 = 4x - 16$
7. a) $3(a - 9b)$
b) $6q(3pq - 2p + 4q)$
8. a) $\frac{12}{m^2}$
b) $6r^{-1}t^{-1} = \frac{6}{rt}$
9. $36 + 14 = 50$
10. $36p^8q^6$
11. a) $2x = 14$
 $x = 7$
b) $5x = 10$
 $x = 2$
c) $3x + 3 = 2x + 8$
 $x = 5$
12. i) $15\% \times 25000 = \$3750$
ii) $(50070 - 3750) \div 60 = \772
iii) $50070 - 25000 = \$25070$
13. i) $A = 9500(1 + 2.4\%)^4$
 $= \$10445.36$
ii) $I = 10445.36 - 9500$
 $= \$945.36$
14. $2x - 3 + 2x - 3 + x + 3 = 3x$
 $x = 7$
15. $m + 6 = 2 - m$
 $m = -2$

16. Lauren is x km from
4 years later $5x + 4$
 $\therefore 4(x + 4) = 5x + 4$
 $x = 12$
 \therefore next birthday party is 16

PART B

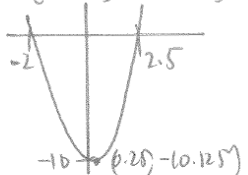
1. a) $5\sqrt{3}$
b) 147
c) $2\sqrt{6} + 4\sqrt{6} - 3\sqrt{6} = 3\sqrt{6}$
d) $= 3 - 2\sqrt{5}$
2. 47
3. $\frac{-4 - 6\sqrt{2}}{7\sqrt{2} + 21} \times \frac{7\sqrt{2} - 21}{7\sqrt{2} - 21} = \frac{98\sqrt{2}}{-343}$
 $= \frac{-2\sqrt{2}}{7}$
4. $16a_1s = 16 \times 2^{10} \times 2^{16} \times 2^{10} \times 2^3$
 $= 2^{37}$
 $I = 2400 \times 12\% \times \frac{8}{12}$
 $= 192$
Total = \$2592
 $P = \frac{10035.20}{(1 - 20\%)^4}$
 $= 24500$
Depreciation = \$14464.80
7. A Interest = \$3040
B $I = 4000(1 + \frac{14.44}{12})^{48} - 4000$
 $= \$3091.28$
 \therefore B better deal

PART D

8. (i) exponential
(ii) x int 2 y int -3
(iii) $y = -4$
(iv) 
9. 
10. i) $k = 15$
ii) $24 = 15 \times C$
 $C = 1.6$ amp

11. i) 
ii) $b_0 = \frac{k}{x+1} + 2$
 $k = -2$
 $a = -1, b = 2, k = -2$

PART E

12. a) $x = \pm 3$
b) $x = \frac{3}{5}, -\frac{1}{2}$
c) $(x+9)(x-2) = 0$
 $x = 2, -9$
13. $x^2 - 12x = 1$
 $(x-6)^2 = 37$
 $x = 6 \pm \sqrt{37}$

14. $x = \frac{-6 \pm \sqrt{32}}{8}$
 $= \frac{-3 \pm \sqrt{2}}{4}$
15. $x^2 + 1 = 0$
no real sol^{ns} as $\Delta < 0$
16. i) $x = -2, \frac{5}{2}$
ii) -10
iii) $x = \frac{1}{4}$
iv) $(0.25, -10.125)$
v) 

17. i) $x(x+2) = 2x(x-2)$
 $x^2 - 6x = 0$
ii) $x = 0, 6$
but $x > 2 \therefore x = 6$
Dims are 6, 8

PART F

18. Circle centre P, r radius r
 $(x-r)^2 + (y-r)^2 = r^2$
Sub in $(4, 5)$
 $1600 - 80r + r^2 + 25 - 10r + r^2 = r^2$
 $r^2 - 90r + 1625 = 0$
 $(r-65)(r-25) = 0$
 $r = 65, 25$
but $r > 40$
 $\therefore r = 65$

19. $3^n = (0.1)^3$
 $9^n = (0.1)^6$
 $9^{-n} = \frac{1}{(0.1)^6}$
 $= 1000000 \text{ or } 10^6$

20. $12099 = 10000 \left(\frac{100+r}{100} \right) \left(\frac{100+r}{100} \right)$
 $r^2 - 202r + 1849 = 0$
 $(r-9)(r+211) = 0$
 $r = 9 \text{ as } > 0$
 $\therefore r = 9\%$