



Student's Name: \_\_\_\_\_  
Teacher's Initials: \_\_\_\_\_

PJR  
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THURSDAY 12<sup>TH</sup> MAY 2022

PERIOD 4/5

TIME: 50 MINUTES

# YEAR 9

## 5.3 MATHEMATICS

### MAJOR ASSESSMENT

### TASK 2

250 copies

Algebra, Products and Factors  
Surds and Pythagoras  
Trigonometry  
Indices

#### INSTRUCTIONS TO STUDENTS:

- \* Write your name and teacher's initials in the spaces indicated.
- \* Write in blue or black pen.
- \* Answer ALL questions in the spaces provided.
- \* Show ALL necessary working.
- \* Marks may not be awarded for careless or badly arranged work.
- \* Diagrams are NOT drawn to scale.
- \* Approved calculators may be used.

Section I – Algebra, Products and Factors	/18 marks
Section II – Surds and Pythagoras	/11 marks
Section III – Trigonometry A	/16 marks
Section IV – Indices	/15 marks
Section V – Working Mathematically	/8 marks
<b>Total</b>	<b>/68 marks</b>

#### Section I – Algebra, Products and Factors (18 marks)

##### Question 1

Expand and simplify:

(a)  $(x + 5)(x + 7)$  1

(b)  $(2x - 3y)(2x + 3y)$  1

(c)  $4a^2 - 2a(3b - 2a) + ab$  2

##### Question 2

Fully factorise:

(a)  $x^2 + 14x + 24$  1

(b)  $3x^2 - 7x - 6$  2

(c)  $50a^2 - 32b^2$  2

**Question 3**

Fully simplify:

(a)  $49ab \div \frac{7a}{b}$

**2**

(b)  $\frac{2xy+2x-6-6y}{4x^2-16x+12}$

**4**

(c)  $\frac{3}{x^2+2x-8} + \frac{2}{x^2+x-6}$

**3****Section II – Surds and Pythagoras (11 marks)****Question 4**

Fully simplify:

(a)  $\sqrt{63}$

**1**

(b)  $\sqrt{56} \div \sqrt{7}$

**2**

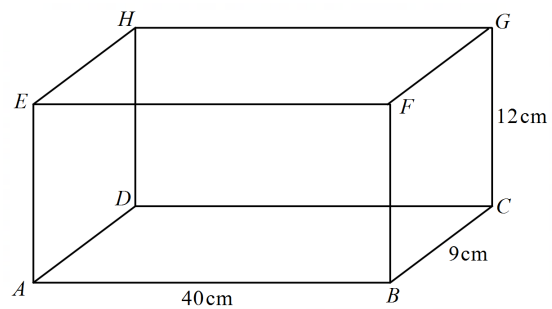
(c)  $3\sqrt{8} \times 2\sqrt{5}$

**2**

(d)  $\sqrt{75} + \sqrt{18} - \sqrt{27} + \sqrt{2}$

**3**

**Question 5**



(i) Find the length of  $AC$  in this rectangular prism.

**1**

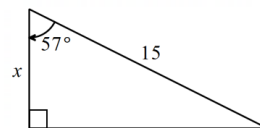
(ii) Hence find the length of the internal diagonal  $AG$ , leaving your answer in simplified surd form. **2**

**Section III – Trigonometry (16 marks)**

**Question 6**

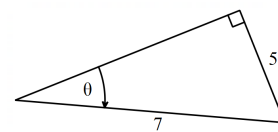
(a) Find the value of  $x$ , correct to 2 decimal places.

**2**



(b) Find the value of  $\theta$ , correct to the nearest degree.

**2**



**Question 7**

A ladder is leaning against a vertical wall and makes an angle of  $78^\circ$  with the ground. The foot of the ladder is 3 metres from the wall. Find the length of the ladder, correct to 2 decimal places.

**3**

### Question 8

A ship leaves port  $P$  and travels  $150\text{ km}$  to port  $Q$  on a bearing of  $100^\circ T$ . It then travels  $120\text{ km}$  to port  $R$  on a bearing of  $190^\circ T$ .

- (i) Draw a diagram, labelling all the given information.

1

- (ii) The path  $PQ$  is perpendicular to the path  $QR$ , hence  $\angle PQR = 90^\circ$ .  
Find  $\angle RPQ$ , correct to the nearest minute.

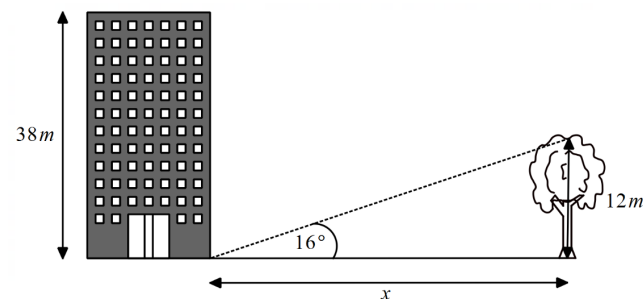
2

- (iii) Hence find the bearing of port  $R$  from port  $P$ .

1

### Question 9

The angle of elevation of the top of a tree from the base of a building is  $16^\circ$ . The tree is  $12\text{ m}$  tall and the building is  $38\text{ m}$  high.



- (i) Find the distance,  $x$  metres, from the base of the building to the base of the tree.  
Answer correct to 1 decimal place.

2

- (ii) On the diagram, draw the angle of depression from the top of the building to the top of the tree. Mark this angle as  $\theta$ .

1

- (iii) Using the value found in part (i), find the angle of depression from the top of the building to the top of the tree.  
Answer correct to the nearest degree.

2

## Section IV – Indices (15 marks)

### Question 10

Simplify each of the following, expressing with only positive indices:

(a)  $x^5y^3 \div x^2y$  1

(b)  $5x^{-2}$  1

(c)  $12x^2 \times 2x^3 \div 8x^4$  2

(d)  $(2x^3)^3$  2

(e)  $9x^0 + (9x)^0$  2

(f)  $\left(\frac{x}{y}\right)^{-4} \times (xy)^4$  2

### Question 11

Express in simplest form without negative indices:

(a)  $\frac{(a^2)^4 \times a^{-2}}{a^5}$  2

(b)  $3x^{-3}y + 9x^{-11}y^2 \div 3x^{-8}y$  3

Section V – Working Mathematically (8 marks)

Question 12

Simplify the following expression, leaving your answer in index form:

$$\frac{4^{x+2} \times 8^x}{2^{2x} \times 2^{x+1}}$$

3

Question 13

Using the expansion  $(\sqrt{a} - \sqrt{b})^2 = a - 2\sqrt{ab} + b$ , evaluate the following expression, leaving your answer in exact surd form:

$$\sqrt{9 + \sqrt{17}} - \sqrt{9 - \sqrt{17}}$$

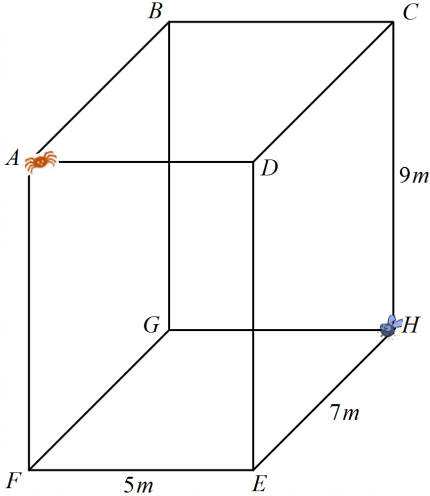
3

Question 14

A spider is in the top corner (point A) of a room that is 7 m long, 5 m wide and 9 m high. It spots a fly that is in the bottom corner (point H) on the other side of the room.

2

What is the shortest distance the spider must travel along the wall and/or ceiling and/or floor to get to the fly?



# Year 9 5.3 Assessment 2

1. a)  $(x+5)(x+7)$   
 $= x^2 + 12x + 35$

b)  $(2x-3y)(2x+3y)$   
 $= 4x^2 - 9y^2$

c)  $4a^2 - 2a(3b-2a) + ab$   
 $= 4a^2 - 6ab + 4a^2 + ab$   
 $= 8a^2 - 5ab$

2. a)  $x^2 + 14x + 24$   
 $= (x+2)(x+12)$

b)  $3x^2 - 7x - 6$   
 $= 3x^2 - 9x + 2x - 6$   
 $= 3x(x-3) + 2(x-3)$   
 $= (x-3)(3x+2)$

c)  $50a^2 - 32b^2$   
 $= 2(25a^2 - 16b^2)$   
 $= 2(5a+4b)(5a-4b)$

3. a)  $49ab \div \frac{7a}{b}$   
 $= 49ab \times \frac{b}{7a}$   
 $= 7b^2$

b)  $\frac{2xy + 2x - 6 - 6y}{4x^2 - 16x + 12}$   
 $= \frac{2x(y+1) - 6(1+y)}{4(x^2 - 4x + 3)}$

$= \frac{(2x-6)(y+1)}{4(x-1)(x-3)}$

$= \frac{2(x-3)(y+1)}{4(x-1)(x-3)}$

$= \frac{y+1}{2(x-1)}$

c)  $\frac{3}{x^2+2x-8} + \frac{2}{x^2+x-6}$   
 $= \frac{3}{(x+4)(x-2)} + \frac{2}{(x+3)(x-2)}$

$= \frac{3(x+3)}{(x+4)(x+3)(x-2)} + \frac{2(x+4)}{(x+4)(x+3)(x-2)}$   
 $= \frac{3x+9+2x+8}{(x+4)(x+3)(x-2)}$

$= \frac{5x+17}{(x+4)(x+3)(x-2)}$

4 a)  $\sqrt{63}$   
 $= \sqrt{9 \times 7}$   
 $= 3\sqrt{7}$

b)  $\sqrt{56} \div \sqrt{7}$   
 $= \sqrt{8}$   
 $= 2\sqrt{2}$

c)  $3\sqrt{8} \times 2\sqrt{5}$   
 $= 6\sqrt{40}$   
 $= 6 \times \sqrt{4} \times \sqrt{10}$   
 $= 12\sqrt{10}$


d)  $\sqrt{75} + \sqrt{18} - \sqrt{27} + \sqrt{2}$   
 $= \sqrt{25 \times 3} + \sqrt{9 \times 2} - \sqrt{9 \times 3} + \sqrt{2}$   
 $= 5\sqrt{3} + 3\sqrt{2} - 3\sqrt{3} + \sqrt{2}$   
 $= 2\sqrt{3} + 4\sqrt{2}$

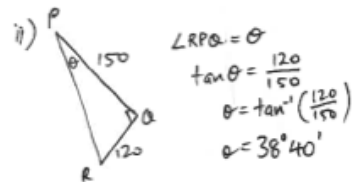
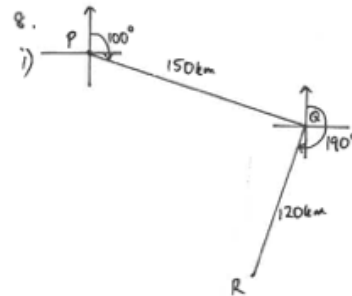
5. i)  $AC^2 = 40^2 + 9^2$   
 $AC^2 = 1681$   
 $AC = 41 \text{ cm}$

ii)  $AG^2 = 41^2 + 12^2$   
 $AG^2 = 1825$   
 $AG = \sqrt{1825}$   
 $= 5\sqrt{73}$

6 a)  $\cos 57 = \frac{x}{15}$   
 $x = 15 \cos 57$   
 $x = 8.17$

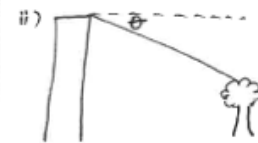
b)  $\sin \theta = \frac{5}{7}$   
 $\theta = \sin^{-1}(\frac{5}{7})$   
 $\theta = 46^\circ$


7.   $\cos 78 = \frac{3}{x}$   
 $x = \frac{3}{\cos 78}$   
 $x = 14.43 \text{ m}$



iii)  $100 + 38^\circ 40'$   
 $= 138^\circ 40'$

9 i)  $\tan 16 = \frac{12}{x}$   
 $x = \frac{12}{\tan 16}$   
 $x = 41.8 \text{ m}$



iii)   $\tan \theta = \frac{26}{41.8}$   
 $\theta = \tan^{-1}(\frac{26}{41.8})$   
 $\theta = 32^\circ$

10 a)  $x^5 y^3 \div x^2 y$   
 $= x^3 y^2$   
b)  $5x^{-2}$   
 $= \frac{5}{x^2}$   
c)  $12x^2 \times 2x^3 \div 8x^4$   
 $= 24x^5 \div 8x^4$   
 $= 3x$

d)  $(2x^2)^3$   
 $= 2^3 x^{2 \times 3}$   
 $= 8x^6$

e)  $9x^0 + (9x)^0$   
 $= 9 \times 1 + 1$   
 $= 9 + 1$   
 $= 10$

f)  $(\frac{x}{y})^{-4} \times (xy)^4$   
 $= (\frac{y}{x})^4 \times x^4 y^4$   
 $= \frac{y^4}{x^4} \times x^4 y^4$   
 $= y^8$

$$\begin{aligned}
 11 \text{ a) } & \frac{(a^3)^4 \times a^{-2}}{a^5} \\
 &= \frac{a^8 \times a^{-2}}{a^5} \\
 &= \frac{a^6}{a^5} \\
 &= a
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } & 3x^{-3}y + 9x^{-11}y^2 \div 3x^{-8}y \\
 &= 3x^{-3}y + 3x^{-3}y \\
 &= 6x^{-3}y \\
 &= \frac{6y}{x^3}
 \end{aligned}$$

$$\begin{aligned}
 12. & \frac{4^{x+2} \times 8^x}{2^{2x} \times 2^{x+1}} \\
 &= \frac{(2^2)^{x+2} \times (2^3)^x}{2^{3x+1}} \\
 &= \frac{2^{2x+4} \times 2^{3x}}{2^{3x+1}} \\
 &= \frac{2^{5x+4}}{2^{3x+1}} \\
 &= 2^{2x+3}
 \end{aligned}$$

$$\begin{aligned}
 13. \text{ Let } x &= \sqrt{9+\sqrt{17}} - \sqrt{9-\sqrt{17}} \\
 x^2 &= (\sqrt{9+\sqrt{17}} - \sqrt{9-\sqrt{17}})^2
 \end{aligned}$$

$$\sqrt{a} = \sqrt{9+\sqrt{17}} \quad \sqrt{b} = \sqrt{9-\sqrt{17}}$$

$$x^2 = 9 + \sqrt{17} - 2\sqrt{9+\sqrt{17}}\sqrt{9-\sqrt{17}} + 9 - \sqrt{17}$$

$$x^2 = 18 - 2\sqrt{9^2 - (\sqrt{17})^2}$$

$$x^2 = 18 - 2\sqrt{81-17}$$

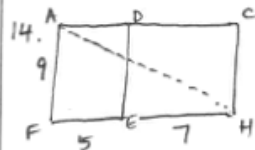
$$x^2 = 18 - 2\sqrt{64}$$

$$x^2 = 18 - 2 \times 8$$

$$x^2 = 2$$

$$x = \sqrt{2}$$

$$\text{so, } \sqrt{9+\sqrt{17}} - \sqrt{9-\sqrt{17}} = \sqrt{2}$$



$$AH^2 = 9^2 + 12^2$$

$$AH^2 = 81 + 144$$

$$AH^2 = 225$$

$$AH = 15 \text{ m}$$