Barker College

**Student Name:** .....

**Teacher's Initials:** .....

ESP DXC
ARP LAK
AYG RAS
GPF*

# YEAR 9

Monday 16th November

# 5.3 MATHEMATICS

Term 3B Week 10, 2020

TIME: 90 minutes

**170 copies**

**INSTRUCTIONS TO STUDENTS:**

This examination consists of TWO sections.

* **Write your name and teacher's initials in the space indicated.**

**SECTION 1 : NON-CALCULATOR (30 minutes)**

* Calculators must NOT be used in this section.
* 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.

**SECTION 2 : CALCULATOR (60 minutes)**

* Calculators MAY be used in this section.
* 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.

* * * *

| | |
|---|---|
| **SECTION 1** | **30 marks** |
| **SECTION 2** | **77 marks** |
| **TOTAL** | **107 marks** |

## SECTION 1: NON-CALCULATOR (30 Marks)

**Marks**

**1.** Write 0.001374 in scientific notation, correct to 2 significant figures. **2**

**2.** Simplify: $\sqrt{4^3}$ **1**

**3.** Simplify: $5^0 + \frac{1}{2^{-1}}$ **2**

**4.** Simplify: $3^{4a} \div 3^{-1}$ **1**

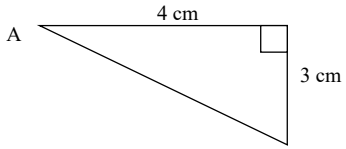
**5.** Find the $x$-intercept of the line with equation $y = 2x + 7$. **2**

**6.** Evaluate: $10 - d^2$ when $d = -4$. **1**

**7.** Mike was sailing on a bearing of 105°. He noticed another yacht straight ahead,

sailing directly towards him. On what bearing was the other yacht sailing? **1**

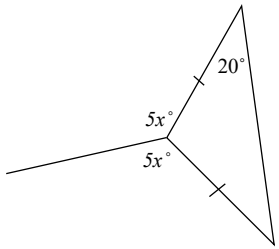
**8.** What ratio is cos A equivalent to? **2**



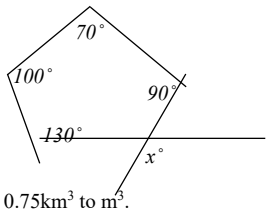

**9.** The exterior angle of a regular polygon is 12°. How many sides does the polygon have? **2**

**10.** Solve for *x (reasons <u>not</u> required)*: **2**

(a)



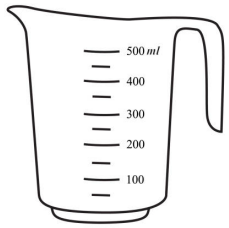

(b) **2**



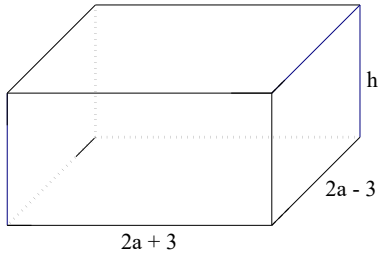

**11.** Convert 0.75km$^3$ to m$^3$. **1**



**12.** Calculate the absolute error of the measuring jug. **1**



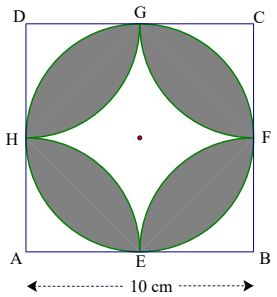

**13.** The rectangular prism below has a volume of $16a^2 - 36$. **2**
Find the height *h*.



**14.** Solve the equations $y = 4x - 3$ and $x - y = -12$ simultaneously. **3**

**15.** ABCD is a square of side length 10 cm.
A circle passes through the midpoints E, F, G and H of each of the sides.
A, B, C and D are the centres of the quadrants AEH, BEF,CFG and DGH respectively.

Find the shaded area, in terms of $\pi$. **3**




**16.** Given *a, b* and *c* are positive numbers (where $a > 1$), solve the following for *x*. **2**



$$ax + b < x - c$$

**End of Section 1**

Student Name: .....

Teacher's Initials: .....

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# YEAR 9

# 5.3 MATHEMATICS

Monday 16th November

Term 3B Week 10, 2020

**170 copies**

## SECTION 2: CALCULATOR

**INSTRUCTIONS TO STUDENTS:**

**SECTION 2: (77 marks)** **Time: 60 minutes**

**There are NINE Parts to this section.**

| Part | Topic | Mark | Your Mark |
|---|---|---|---|
| A | Products and Factors | 11 | |
| B | Equations and Inequations | 10 | |
| C | Consumer Arithmetic | 7 | |
| D | Trigonometry | 8 | |
| E | Congruence and Similarity | 7 | |
| F | Surface Area and Volume | 9 | |
| G | Coordinate Geometry | 10 | |
| H | Data | 6 | |
| I | Problem Solving | 9 | |
| | Total | 77 | |

- **Attempt ALL questions.**
- **Show ALL working.**
- **Approved calculators MAY be used.**
- **Write your answers in the spaces provided on the paper.**
- **Marks may not be awarded for careless or badly arranged work.**
- **Diagrams are NOT drawn to scale.**
- **Write your FULL name and teacher's initials on EVERY sheet of paper.**

## Part A: Products and Factors (11 marks)

**Question 1**

Expand and simplify: $(3x-2)^2$ **2**

**Question 2**
Fully factorise:

(a) $x^2 - x - 30$ **1**

(b) $12x^2 + 11x - 5$ **3**

(c) $2a - ax - bx + 2b$ **2**

**Question 3**

Fully simplify: $\dfrac{x^2 - 5x + 6}{x^2 - 2x}$ **3**

**End of Part A**

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## Part B: Equations and Inequations (10 marks)

**Question 4**

Solve:

(a) $14 - 3x = 2 - 6x$ **2**

(b) $\frac{2a-3}{3} - \frac{3a-4}{4} = 2$ **3**

**Question 5**

Solve $\frac{8-k}{2} > -5$, graphing your answer on the number line below. **3**

**Question 6**

Rearrange to make $k$ the subject.

$ak - d = 3x$ **2**

**End of Part B**



## Part C: Consumer Arithmetic (7 marks)

**Question 7**

Jack's pay for a $37\frac{1}{2}$ hour week is \$697.50.

(i) What is his hourly pay rate? **1**

(ii) If he gets $17\frac{1}{2}\%$ holiday leave loading on 4 weeks of his pay, calculate his holiday pay. **2**

**Question 8**

Sarah has a salary of \$121600, receives income from other sources of \$8500 and has tax deductions of \$2350.

**Resident tax rates 2020–21**

| Taxable income | Tax on this income |
|---|---|
| 0 – $18,200 | Nil |
| $18,201 – $45,000 | 19 cents for each $1 over $18,200 |
| $45,001 – $120,000 | $5,092 plus 32.5 cents for each $1 over $45,000 |
| $120,001 – $180,000 | $29,467 plus 37 cents for each $1 over $120,000 |
| $180,001 and over | $51,667 plus 45 cents for each $1 over $180,000 |

Find:

(i) her taxable income **1**

(ii) her tax payable **3**

**End of Part C**

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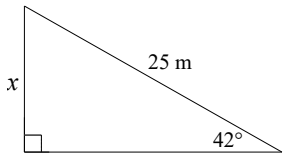
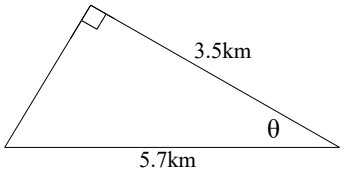
## Part D: Trigonometry (8 marks)

**Question 9**

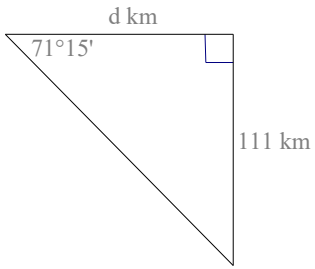
(a) Find $x$, correct to 1 decimal place. **2**




(b) Find $\theta$, correct to the nearest minute. **2**



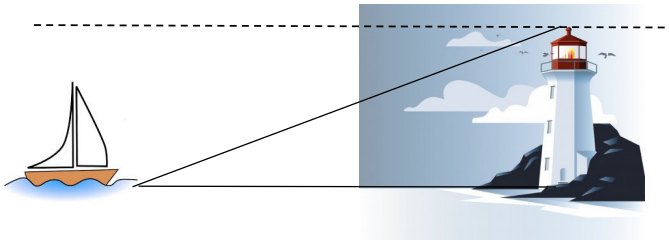

(c) Find $d$, correct to the nearest km. **2**






**Question 10**

From the top of a lighthouse, Jack spots a boat out at sea.



If the top of the lighthouse is 20 m above sea level and the boat is 70 metres away from its base, find Jack's angle of depression to the boat *(to the nearest degree).* **2**

**End of Part D**

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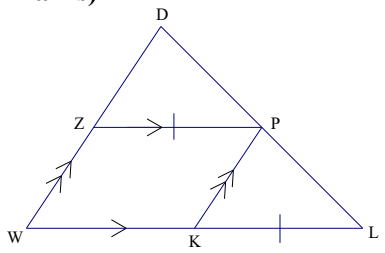
## Part E: Congruence and Similarity (7 marks)

**Question 11**



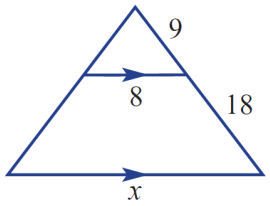

(i) Why is $\angle ZWK = \angle PKL$? **1**

(ii) Prove that $\Delta\ ZDP \equiv \Delta KPL$. **3**

(iii) Why is DZ = PK? **1**

**Question 12**

Find the value of $x$. **2**




**End of Part E**



## Part F: Surface Area and Volume (9 marks)

**Question 13**

What formula is used to find the volume of a cone? **1**

(A) $V = \pi r^2 h$ (B) $V = \frac{4}{3}\pi r^3$ (C) $V = \frac{1}{2}\pi r^2 h$ (D) $V = \frac{1}{3}\pi r^2 h$

**Question 14**

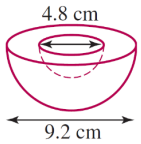
A closed cylinder has a radius of 15 cm and a length of 90 cm.

(i) Find the **volume** of the cylinder correct to 1 decimal place. **2**

(ii) Find the **surface area** of the cylinder correct to 4 significant figures **3**

**Question 15**

Calculate the **volume** of the following solid *(correct to 1 decimal place)*: **3**




**End of Part F**

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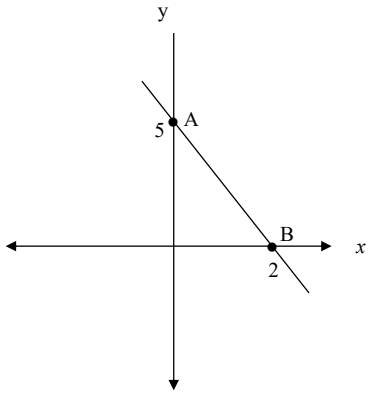
## Part G: Coordinate Geometry (10 marks)

**Question 16**

(i) Find the exact length of $AB$. **2**




(ii) Find the gradient of $AB$. **1**

(iii) Write down the equation of the line through $A$ and $B$. **2**



**Question 17**

The line $y = 2x - k$ passes through the point (2, 1). Find $k$. **1**

**Question 18**

Find the coordinates of the midpoint of (12, -3) and (-2, 8) **2**

**Question 19**

Find the equation of the line which passes through the points *(-a, b)* and *(a, 3b)*. **2**

**End of Part G**

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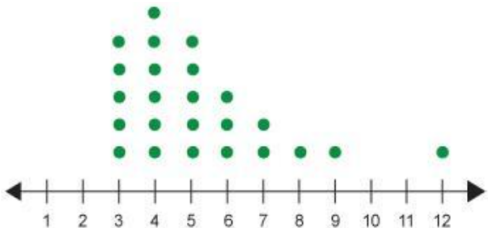
## Part H: Data (6 marks)

**Question 20**

Using the label of symmetrical, positively skewed or negatively skewed, describe how the data in this dot-plot is distributed. **1**




**Question 21**

Complete a five-figure summary for the following frequency distribution table and construct a box plot of the data.

| Score | Frequency |
|---|---|
| 3 | 4 |
| 4 | 1 |
| 5 | 7 |
| 6 | 6 |
| 7 | 2 |
| 8 | 4 |
| 9 | 0 |

Min =

Q1 =

Q2 =

Q3 =

Max = **3**

**2**

**End of Part H**



## Part I: Problem Solving (9 marks)

**Question 22**

The area of a triangle enclosed by the lines $x = 1$, $y = 3x$ and $y = b$ is $6\ cm^2$.
Find the values of $b$ that make this triangle. **3**

**Question 23**

Simplify: $\dfrac{2}{2-x} + \dfrac{1}{x+2} + \dfrac{8}{x^2-4}$ **3**

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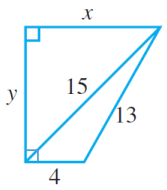
**Question 24**

By forming a pair of equations and solving them simultaneously, find the values of $x$ and $y$. **3**




**End of Part I**

**End of Paper**



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**NON CALC**

1. $1.4 \times 10^{-3}$
2. 8
3. $1+2=3$
4. $3^{4a+1}$
5. $y=0 \quad \therefore 2x=7$
   $x=-3.5$
6. $=10-16$
   $=-6$
7. $285^\circ$
8. $\cos A = \frac{4}{5}$
9. $n=\frac{360}{12}$
   $=30$
10. a) $10x+140=360$
    $x=22$
    b) $x=150^\circ$
11. $0.75 \times 1000^3 = 750\,000\,000$
    $= 7.5 \times 10^8$
12. $\pm 25\text{ml}$
13. $(2a+3)(2a-3)h = 16a^2-36$
    $(4a^2-9)h = 16a^2-36$
    $h=4$
14. $x-(4x-3)=-12$
    $3x=15$
    $x=5$
    $y=17$
15. Quad GCFO $= 25\text{ cm}^2$
    White GCF $= 25-\frac{25\pi}{4}$
    Shade GCFO $= 25-\left(50-\frac{25\pi}{2}\right)$
    $=\frac{25\pi}{2}-25$
    $\therefore$ Total Shade $= 4\left(\frac{25\pi}{2}-25\right)$
    $=50\pi-100\text{ cm}^3$
16. $ax-x<-b-c$
    $x(a-1)<-b-c$
    $x<\frac{-b-c}{a-1}$

**CALCULATOR**

1. $=9x^2-12x+4$
2. a) $=(x-6)(x+5)$
   b) $=12x^2+15x-4x-5$
   $=3x(4x+5)-(4x+5)$
   $=(4x+5)(3x-1)$
   c) $=a(2-x)+b(-x+2)$
   $=(2-x)(a+b)$
3. $=\frac{(x-3)(x-2)}{x(x-2)}$
   $=\frac{x-3}{x}$
4. a) $3x=-12$
   $x=-4$
   b) $4(2a-3)-3(3a-4)=24$
   $a=-24$
5. $k<18$


6. $ak=3x+d$
   $k=\frac{3x+d}{a}$
7. (i) \$18.60
   (ii) $697.5 \times 4 \times 117.5\% = \$3278.25$
8. (i) \$127750
   (ii) Tax $= 29467+372 \times 7750$
   $= \$32334.50$





9. a) $\sin 42 = \frac{x}{25}$
   $x=16.7\text{ m}$
   b) $\cos\theta = \frac{3.5}{5.7}$
   $\theta = 52^\circ 7'$
   c) $\tan 71^\circ 15' = \frac{111}{d}$
   $d=37.7\text{ km}$
   $=38\text{ km}$
10. $\tan\theta = \frac{20}{70}$
    $\theta = 16^\circ$
    Angle of depression $= 16^\circ$
11. (i) corresponding $\angle$'s on $\parallel$ lines
    (ii) $ZP = KL$ (given)
    $\angle DPZ = \angle PLK$ (corresponding $\angle$'s on $\parallel$ lines)
    $\angle ZDP = \angle KPL$ ( " " " " )
    $\therefore \triangle ZDP \equiv \triangle KPL$ (AAS)
    (iii) matching sides in $\equiv \triangle$'s
12. $\frac{x}{8} = \frac{27}{9}$
    $x=24$
13. (C) $V = \frac{1}{3}\pi r^2 h$
14. (i) $V = \pi r^2 h$
    $= 63617.3\text{ cm}^3$
    (ii) $SA = 2\pi r^2 + 2\pi rh$
    $= 9896\text{ cm}^2$
15. Hemisphere $= \frac{2}{3}\pi r^3$
    $V = \frac{2}{3}\pi \times 4.6^3 - \frac{2}{3}\pi \times 2.4^3$
    $= 174.9\text{ cm}^3$
16. (i) $AB = \sqrt{29}$
    (ii) $m = -2.5$
    (iii) $y = -2.5x + 5$
17. $1 = 4-k$
    $k=3$
18. M is $(5, 2.5)$
19. $m = \frac{b}{a}$
    $y-b = \frac{b}{a}(x+a)$
    $y = \frac{b}{a}x + 2b$
20. Positively
21. Min $=3$, $Q_1 = 5$, $Q_2 = 5.5$
    $Q_3 = 6.5$, Max $= 8$


22. Intercept of $y=b$, $y=3x$
    $\left(\frac{b}{3}, b\right)$
    $\therefore 6 = \left(\frac{b}{3}-1\right)(b-3) \times \frac{1}{2}$
    $(b-3)^2 = 36$
    $b-3 = \pm 6$
    $b=9$ or $-3$
23. $= \frac{-2(x+2)+x-2+8}{(x+2)(x-2)}$
    $= \frac{-(x-2)}{(x-2)(x+2)}$
    $= \frac{-1}{x+2}$
24. $x^2+y^2=225$
    $(x-4)^2+y^2=169$
    $x^2-8x+16+225-x^2=169$
    $8x=72$
    $x=9$
    $y=12$