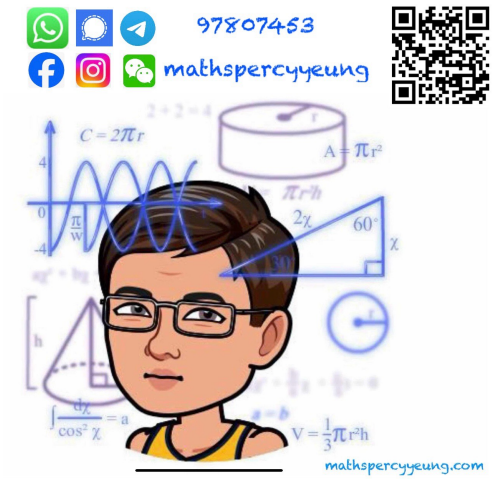
20-21 F.3
1st TERM EXAM
MATH



2020 – 2021
Form 3 First Term Examination

MATHEMATICS

Question–Answer Book

7th January, 2021
8:15 am – 9:45 am (1 hour 30 minutes)
This paper must be answered in English

INSTRUCTIONS

1. Write your name, class and class number in the spaces provided on this cover.

2. Answer ALL questions in Section A. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured. You should mark only ONE answer for each question. If you mark more than one answer, you will receive NO MARKS for that question.

3. Attempt ALL questions in Sections B and C. Write your answers in the spaces provided in this Question – Answer Book.

4. Unless otherwise specified, all working must be clearly shown and numerical answers should be either exact or correct to 3 significant figures.

5. The diagrams in this paper are not necessarily drawn to scale.

Sections	Marks
A Total	**/30**
B (31 – 33)	
B (34 – 38)	
B Total	**/40**
C Total	**/30**
TOTAL	**%**

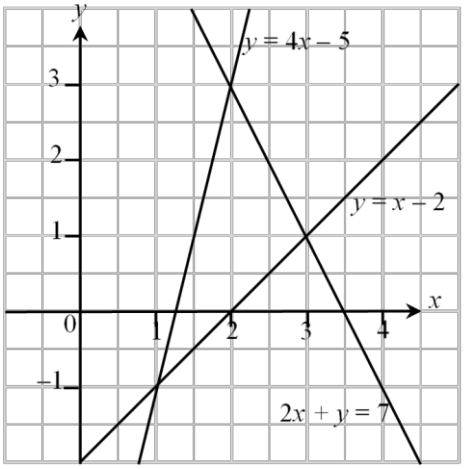
Section A (30 marks)

Choose the best answer for each question.

1. 0.012 566 2 =

   A. 0.012 (correct to 3 significant figures).
   B. 0.0125 (correct to 4 decimal places).
   C. 0.01256 (correct to 5 significant figures).
   D. 0.012566 (correct to 6 decimal places).

2. The figure shows the graphs of $2x + y = 7$, $y = x - 2$ and $y = 4x - 5$. Solve the simultaneous equations $\begin{cases} y = 4x - 5 \\ y = x - 2 \end{cases}$ graphically.



   A. (1, –1)
   B. (2, 0)
   C. (2, 3)
   D. (3, 1)

3. $-5(-3^2)^0$ =

   A. –45.
   B. –5.
   C. 5.
   D. 45.

4. $x^5(3x - x)$ =

   A. $2x^6$.
   B. $2x^7$.
   C. $3x^4$.
   D. $3x^5$.

5. Which of the following numbers is in scientific notation?

   A. 50.4×10^8
   B. 5.04×10^9
   C. 0.504×10^{10}
   D. 0.0504×10^{11}

6. Which digit has place value 16^3 in the hexadecimal number F68E?

   A. F
   B. 6
   C. 8
   D. E

7. Which of the following is an identity / are identities?

   I. $4x^2 - 4x + 1 = 0$
   II. $4x^2 - 4x + 1 = (2x - 1)^2$
   III. $4x^2 + 1 > 0$

   A. I only
   B. II only
   C. I and III only
   D. II and III only

8. $pq - 2pr + qr - 2r^2 =$

A. $(p - r)(q + 2r)$.
B. $(q - r)(p + 2r)$.
C. $(p + r)(q - 2r)$.
D. $(q + r)(p - 2r)$.

9. Factorize $k^2 - 3k - 18$.

A. $(k - 3)(k + 6)$
B. $(k - 3)(k - 6)$
C. $(k + 3)(k + 6)$
D. $(k + 3)(k - 6)$

10. $9x^2 - 31xy + 26y^2 =$

A. $(x + 2y)(9x - 13y)$.
B. $(x + 2y)(9x + 13y)$.
C. $(x - 2y)(9x - 13y)$.
D. $(x - 2y)(9x + 13y)$.

11. $64 - y^3 =$

A. $(4 + y)(16 + 4y + y^2)$.
B. $(4 + y)(16 - 4y - y^2)$.
C. $(4 - y)(16 + 8y + y^2)$.
D. $(4 - y)(16 + 4y + y^2)$.

12. When a number decreases by 20%, it becomes 75. The original number is

A. 60.
B. 62.5.
C. 90.
D. 93.75.

13. Howard's income and expenditure were \$20 000 and \$15 000 respectively in June. He saved the remaining. In July, his income increased by 20% and his expenditure was decreased by 20%. In July, he saves

A. \$5000.
B. \$7000.
C. \$8000.
D. \$12000.

14. Tracy deposits \$4000 in a bank on simple interest at an interest rate of 6% p.a. How much interest will she receive in three months?

A. \$40
B. \$60
C. \$80
D. \$240

15. A sum of \$2000 is deposited at an interest rate of 2.5% p.a. for 4 years, compounded half-yearly. The amount at the end of the fourth year is

A. \$2102, correct to the nearest dollar.
B. \$2198, correct to the nearest dollar.
C. \$2209, correct to the nearest dollar.
D. \$2210, correct to the nearest dollar.

16. The rateable value of a flat is \$600000. If the rates are charged at 5% p.a., find the rates payable for the flat per quarter.

A. \$7500
B. \$9000
C. \$30000
D. \$90000

17. Which of the following cannot be the probability of an event?

I. -1

II. 2

III. $\frac{1}{\pi}$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

18. The following table shows the number of S3 students in a school who participated in Walks for Millions in a certain year.

Class	3A	3B	3C	3D
Boys	12	8	7	15
Girls	13	10	7	18

If a student is chosen at random from the S3 participants, find the probability that he/she is from class 3B.

A. $\frac{4}{45}$
B. $\frac{1}{9}$
C. $\frac{1}{5}$
D. $\frac{1}{4}$

19. Danny throws a dice. He can get 6 points if the number on the dice is greater than 4; otherwise, he gets no points. Find the expected value of the points he gets.

A. 4
B. 3
C. 2
D. 1

20. Mrs Lee has 3 children. Find the probability that exactly 2 of the children are boys.

A. $\frac{1}{2}$
B. $\frac{1}{4}$
C. $\frac{3}{8}$
D. $\frac{2}{3}$

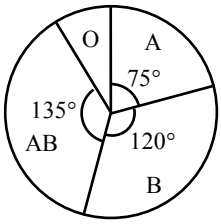
21. Two dice are thrown. Find the probability that the difference of the numbers is larger than 2.

A. $\frac{1}{2}$
B. $\frac{1}{3}$
C. $\frac{2}{3}$
D. $\frac{2}{9}$

22. The pie chart shows the blood types of a group of students. If a student is randomly chosen from the group, find the probability that the student is of blood type A or B.

A. $\frac{3}{8}$
B. $\frac{9}{22}$
C. $\frac{13}{24}$
D. $\frac{13}{22}$

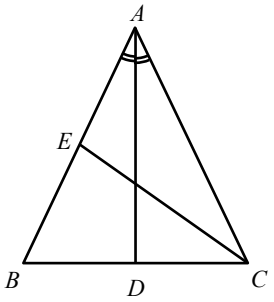
The blood types of a group of students



23. Which of the following must be the centre of the inscribed circle of a triangle?

A. The centroid of the triangle
B. The orthocentre of the triangle
C. The circumcentre of the triangle
D. The in-centre of the triangle

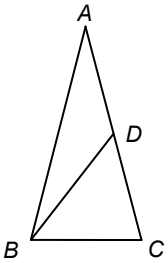
24. In the figure, $\triangle ABC$ is an acute-angled triangle. D is a point on BC such that $\angle BAD = \angle CAD$. CE is a median of $\triangle ABC$. Which of the following must be true?



I. The in-centre of $\triangle ABC$ lies on AD.
II. The centroid of $\triangle ABC$ lies on CE.
III. The circumcentre of $\triangle ABC$ lies on AD.

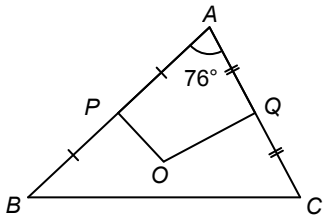
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

25. In the figure, BD is the median of AC in $\triangle ABC$ and $AB = AC = 2BC$. If the perimeter of $\triangle ABC$ is 10 cm, find the length of CD.



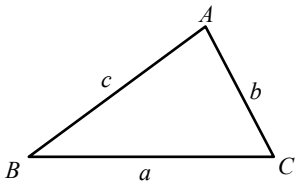
A. 1 cm
B. 2 cm
C. 3 cm
D. 4 cm

26. In the figure, O is the circumcentre of $\triangle ABC$. P and Q are points on AB and AC respectively such that $AP = BP$ and $AQ = CQ$. If $\angle BAC = 76°$, find $\angle POQ$.



A. 104°
B. 120°
C. 142°
D. 152°

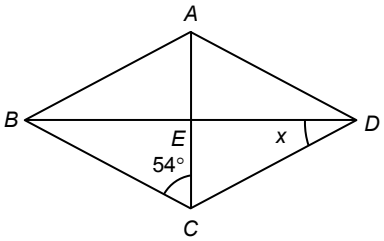
27. In the figure, $\triangle ABC$ is triangle with $a > c > b$. Which of the following must be true?



I. $a + b > c$
II. $b + c > a$
III. $b^2 + c^2 > a^2$

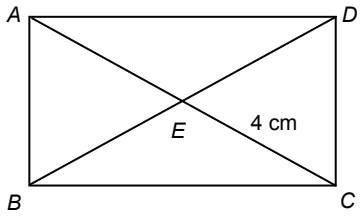
A. I only
B. I and II only
C. I and III only
D. I, II and III

28. In the figure, $ABCD$ is a rhombus. The diagonals AC and BD intersect at E. Find x.



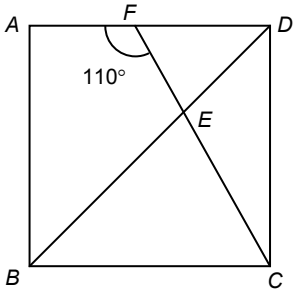
A. 27°
B. 36°
C. 46°
D. 54°

29. In the figure, $ABCD$ is a rectangle. The diagonals AC and BE intersect at E. If $EC = 4$ cm, find the length of BD.



A. 4 cm
B. 6 cm
C. 8 cm
D. 10 cm

30. In the figure, $ABCD$ is a square. AFD, BED and CEF are straight lines. If $\angle AFE = 110°$, find $\angle DEF$.



A. 35°
B. 45°
C. 60°
D. 65°

End of Section A

Section B (40 marks)

31. Consider the formula $y = \dfrac{z+1}{x-4}$

(a) Make x the subject of the formula.

(b) If $y = 2$ and $z = -1$, find the value of x. (5 marks)

32. Solve the simultaneous equations $\begin{cases} 2x + 3y = 0 \\ x + 5y = 7 \end{cases}$.

(5 marks)

33. (a) Solve the inequality $\frac{x-5}{4} \leq x+3$.

(b) If x is an integer, find the least possible value of x.

(4 marks)

34. Simplify $\frac{(p^6q^2)^{-3}}{q^7}$ and express your answer with positive indices. (4 marks)

35. (a) Express the following numbers in scientific notation.

(i) 0.00007

(ii) 240×10^{10}

(iii) 3000

(b) Without using a calculator, find the value of $\dfrac{(0.00007)\times(240\times10^{10})}{3000}$, and express your answer in scientific notation.

(6 marks)

36. (a) Factorize $3c^2 + 10c - 8$.

(b) Hence factorize $3cd + 12d + 3c^2 + 10c - 8$.

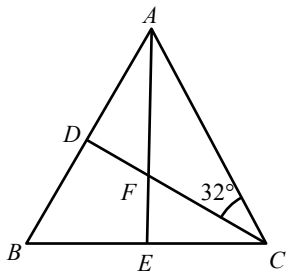
(5 marks)

37. In the figure, ADB, BEC and AFE are straight lines. AE is the angle bisector of $\angle BAC$. CD is an altitude of $\triangle ABC$. Given that $\angle ACD = 32°$, find

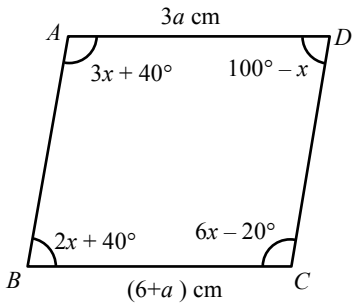
(a) $\angle CDA$,

(b) $\angle BAE$,

(4 marks)



38. In the figure, $ABCD$ is a quadrilateral. If $AD = 3a$ cm, $BC = (6 + a)$ cm, $\angle BAD = 3x + 40°$, $\angle ABC = 2x + 40°$, $\angle BCD = 6x - 20°$, and $\angle ADC = 100° - x$.



(a) Find x.

(b) Prove that $ABCD$ is a parallelogram.

(c) Hence, find a.

(7 marks)

Section C (30 marks)

39. The table below shows the salaries tax at progressive rate:

Net chargeable income	Tax rate
On the first $40 000	2%
On the next $40 000	7%
On the next $40 000	12%
Remainder	17%

Anna is a store manager, her basic monthly salary was $23000 and she received a $4000 bonus last year.

(a) If her monthly salary increased by 5% and her bonus decreased by 2% this year, find the percentage change in her annual income.

(3 marks)

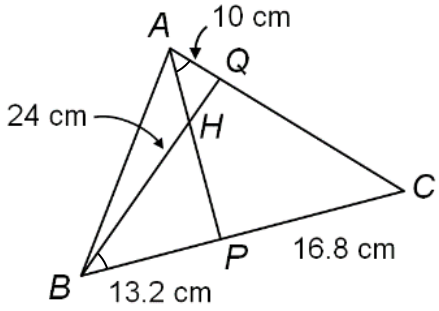
(b) If her salaries tax allowance is $120000, how much salaries tax at progressive rates should Anna pay this year?

(4 marks)

(c) Anna deposited 20% of her annual income in a bank at an interest rate of 3% p.a. If the interest is compounded monthly, find the amount she will get after 5 years.

(3 marks)

40. In the figure, H is the orthocentre of $\triangle ABC$. AH and BH are produced to meet BC and AC at P and Q respectively. If $\angle HAQ = \angle HBP$, $AQ = 10$ cm, $BQ = 24$ cm, $BP = 13.2$ cm and $PC = 16.8$ cm.



(a) Prove that $\triangle AHQ \sim \triangle BHP$. (3 marks)

(b) Find the lengths of AB and AP. (4 marks)

(c) Find the area of $\triangle ABC$. (3 marks)

41. There are 3 red apples and a green apple in a box. Two apples are chosen simultaneously at random. If exactly one of the two apples is red, then Katy gets 10 point; if they are both red, then Katy gets 20 points.

(a) Let R_1 , R_2 and R_3 stand for the three red apples and G stand for the green apple respectively. Write down the possible outcomes in the following table.

2nd apple chosen

1st apple chosen				

(3 marks)

(b) Find the total number of possible outcomes. (1 mark)

(c) Find the probability that

(i) exactly one of the two apples is red,

(ii) both apples are red.

(3 marks)

(d) Find the expected points that Katy gets. (3 marks)

End of Paper