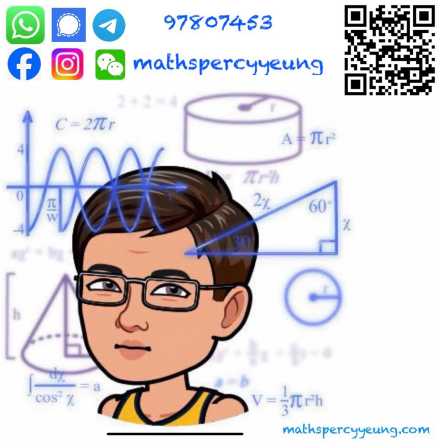
17-18 F.3
1st TERM EXAM
MATH



2017 – 2018
Form 3 First Term Examination

MATHEMATICS

Question–Answer Book

11th January, 2018
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 – 32)	
B (33 – 37)	
B Total	**/40**
C Total	**/30**
TOTAL	**/100**

Section A (30 marks)

Choose the best answer for each question.

1. If $a \neq 0$, which of the following must be true?

   A. $a^0 = 0$
   B. $\frac{a^3}{a^{-5}} = \frac{1}{a^8}$
   C. $a^{-1} \times a^{-2} = a^2$
   D. $(a^{-1})^4 = \frac{1}{a^4}$

2. $\frac{m^{-7}}{m^{-2} \times m^{-3}} =$

   A. $-\frac{1}{m^2}$.
   B. $\frac{1}{m^2}$.
   C. $\frac{1}{m^{13}}$.
   D. m^2.

3. What is the place value of the digit '0' in the number 10111_2?

   A. 0
   B. 2^3
   C. 2^4
   D. 1000

4. $1 \times 64 + 1 \times 16 + 1 \times 8 + 1 \times 2 =$

   A. 101110_2.
   B. 101101_2.
   C. 1011100_2.
   D. 1011010_2.

5. 608 740 000 =

   A. 6.08×10^8. (cor. to 3 sig. fig.)
   B. 6.09×10^8.(cor. to 3 sig. fig.)
   C. 6.09×10^9.(cor. to 3 sig. fig.)
   D. 6.09×10^{-8}.(cor. to 3 sig. fig.)

6. If n is a positive integer, then $\frac{2^{4n} \times 6^{2n}}{27^n} =$

   A. $\frac{2^6}{3}$.
   B. $\frac{2^8}{3^5}$.
   C. $\frac{2^{6n}}{3^n}$.
   D. $\frac{2^{8n}}{3^{5n}}$.

7. Which of the following are the factor(s) of $x^2 + 12x - 13$?

   I. $x + 1$
   II. $x - 1$
   III. $x + 13$

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

8. Factorize $4x^2 + 19x + 12$.

   A. $(x + 2)(4x + 6)$
   B. $(x + 4)(4x + 3)$
   C. $(2x + 6)(2x + 2)$
   D. $(2x + 4)(2x + 3)$

9. Factorize $8z^3 + 27$.

A. $(2z + 3)(4z^2 - 6z + 9)$
B. $(2z + 3)(4z^2 - 12z + 9)$
C. $(2z - 3)(4z^2 - 6z - 9)$
D. $(2z - 3)(4z^2 - 12z - 9)$

10. Factorize $p^2 - 2pq - 3q^2 - p + 3q$.

A. $(p + 3q)(p - q + 1)$
B. $(p + 3q)(\mathrm{p} - q - 1)$
C. $(p - 3q)(p + q + 1)$
D. $(p - 3q)(p + q - 1)$

11. The value of a computer has decreased by 12% each year. It is known that the present value of the computer is \$7000. Find the value of the computer two years ago.

A. \$5420, *cor. to 3 sig. fig.*
B. \$5580, *cor. to 3 sig. fig.*
C. \$8780, *cor. to 3 sig. fig.*
D. \$9040, *cor. to 3 sig. fig.*

12. Find the simple interest obtained if \$3000 is deposited in a bank at 4% p.a. for $2\frac{1}{2}$ years.

A. \$120
B. \$240
C. \$300
D. \$400

13. The principal \$$P$ is deposited in a bank at 6% p.a. compounded monthly. The amount received after 3 years is

A. $\$P\left(1+\frac{6}{100}\right)^3$.
B. $\$P\left(1+\frac{3}{100}\right)^6$.
C. $\$P\left(1+\frac{1}{100}\right)^{36}$.
D. $\$P\left(1+\frac{1}{200}\right)^{36}$.

14. The property tax paid by an owner of a flat is \$10 800 this year. If the property tax rate is 15%, find the quarterly rental income of the flat.

A. \$6000
B. \$7500
C. \$22 500
D. \$24 000

15. If the lengths of all the sides of a rectangle are increased by 20%, the percentage change in its area is

A. +20%.
B. +40%.
C. +44%.
D. +144%.

16. 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

17. There are 100 balls numbered 1 to 100 in a bag. One ball is drawn at random from the bag. Find the probability that the number on the ball is divisible by 3.

A. $\frac{3}{10}$
B. $\frac{33}{100}$
C. $\frac{1}{3}$
D. $\frac{9}{25}$

18. A dice is thrown 100 times and the results are recorded as follows:

Number	1	2	3	4	5	6
Frequency	11	x	14	22	16	19

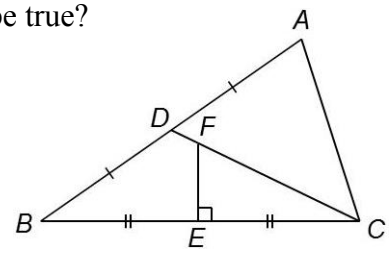
Find the experimental probability of getting a '2'.

A. 0.12
B. 0.15
C. 0.18
D. 0.21

19. Peter has one \$1.4-stamp, two \$2.2-stamps and two \$3-stamps. If he picks a stamp at random, find the expected value of the stamp.

A. \$1.32
B. \$2.2
C. \$2.36
D. \$2.4

20. In the figure, ADB, BEC and CFD are straight lines. Which of the following must be true?



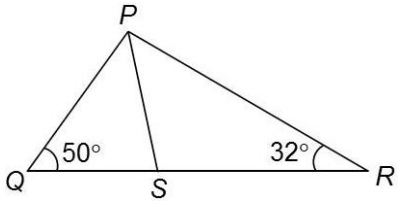
I. CD is a median of $\triangle ABC$.

II. EF is a perpendicular bisector of $\triangle ABC$.

III. EF is an altitude of $\triangle BCD$.

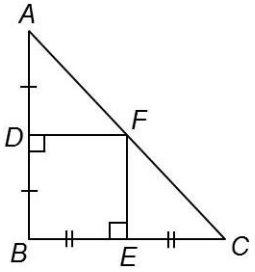
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

21. In the figure, QSR is a straight line. If PS is the angle bisector of $\angle QPR$, then $\angle QPS =$



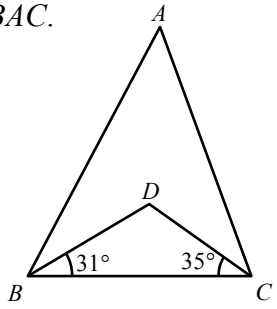
A. 41°.
B. 45°.
C. 49°.
D. 50°.

22. In the figure, ADB, BEC and AFC are straight lines. F is



A. the incentre of $\triangle ABC$.
B. the circumcentre of $\triangle ABC$.
C. the centroid of $\triangle ABC$.
D. the orthocentre of $\triangle ABC$.

23. In the figure, D is the in-centre of $\triangle ABC$. Find $\angle BAC$.



A. 48°
B. 58°
C. 66°
D. 114°

24. In each of the following, the lengths of three line segments are shown. Which set of line segments can form a triangle?

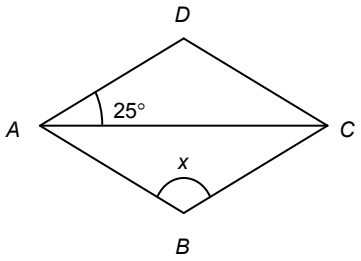
A. 5, 6, 12
B. 4, 9, 13
C. 6, 10, 14
D. 7, 7, 15

25. Which of the following must be true?

I. The sizes of opposite angles of a parallelogram are equal.
II. The diagonals of a rectangle bisect each interior angle.
III. The lengths of opposite sides of a rhombus are equal.

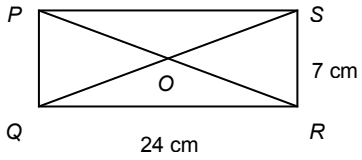
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

26. In the figure, $ABCD$ is a rhombus. Find x.



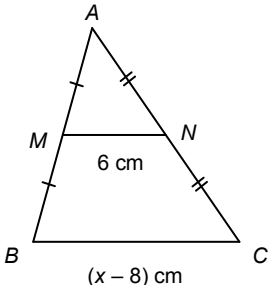
A. 120°
B. 125°
C. 130°
D. 135°

27. In the figure, $PQRS$ is a rectangle. PR and QS intersect at O. OS =



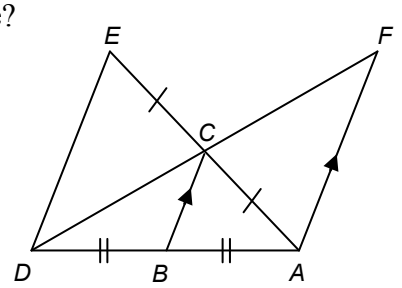
A. 12.5 cm.
B. 13 cm.
C. 25 cm.
D. 26 cm.

28. The figure shows $\triangle ABC$. M and N are the mid-points of AB and AC respectively. Find the value of x.



A. 14
B. 16
C. 18
D. 20

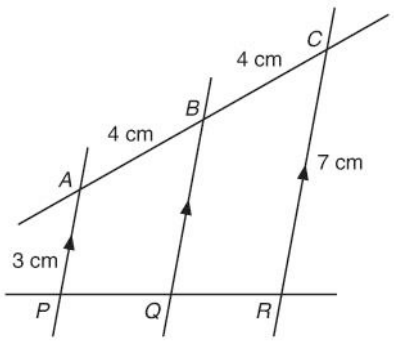
29. In the figure, ABD, ACE and DCF are straight lines. B and C are the mid-points of AD and AE respectively. It is given that BC // AF. Which of the following must be true?



I. $DC = CF$
II. AF // DE
III. $\angle CDE = \angle CAF$

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

30. In the figure, ABC and PQR are straight lines. It is given that AP // BQ // CR, AP = 3 cm and CR = 7 cm. Find the length of BQ.



A. 4 cm
B. 4.5 cm
C. 5 cm
D. 6 cm

End of Section A

Section B (40 marks)

31. Consider the formula $2r - s = \frac{8r}{3}$.

(a) Make r the subject of the formula.

(b) If $s = -10$, find the value of r. (5 marks)

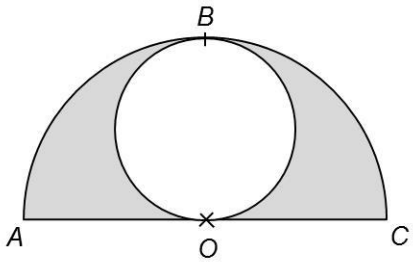
32. In the figure, the shaded region is formed by cutting out a circle from a semi-circle ABC. It is given that O is the centre of the semi-circle, OB is the diameter of the circle and $OA = 20$ cm.

(a) Find the area of the shaded region.

(b) Find the perimeter of the shaded region.

(Give your answers in terms of π.)

(5 marks)



33. Simplify the following expressions and express your answers with positive indices. (6 marks)

(a) $\dfrac{a^{-5}b^{0}}{(a^{-2}b^{4})^{-2}}$

(b) $p^{-5}q^{2}\times\left(\dfrac{p^{3}}{q}\right)^{4}$

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

(i) 2 700 000

(ii) 0.000 056

(iii) -47×10^{-6}

(b) Without using a calculator, find the value of $\dfrac{2\,700\,000}{-47\times10^{-6}+0.000\,056}$, and express your answer in scientific notation.

(6 marks)

35. (a) Factorize $a^2 + 4a - 5$.

(b) Hence factorize $a^2 + 4a - 5 + ab + 5b$.

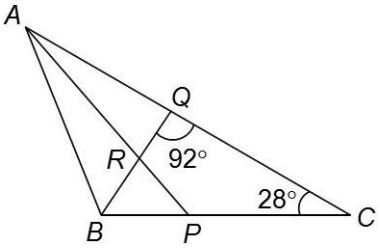
(5 marks)

36. In the figure, P and Q are points on BC and AC respectively such that AP and BQ are the angle bisectors of $\angle BAC$ and $\angle ABC$ respectively. AP and BQ intersect at R. If $\angle ACB = 28°$ and $\angle BQC = 92°$, find

(a) $\angle ABQ$,

(b) $\angle BAR$.

(6 marks)

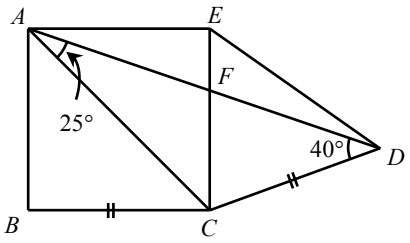


37. In the figure, $ABCE$ is a square. CDE is a triangle, where $BC = CD$. AD intersects EC at F such that $\angle CAD = 25°$ and $\angle ADC = 40°$.

(a) Find $\angle DCF$.

(b) Find $\angle ADE$.

(7 marks)



Section C (30 marks)

38. In a lucky draw, a participant needs to draw a ball from each of bag *A* and *B*. Bag *A* contains 2 white balls, 1 blue ball and 1 red ball. Bag *B* contains 1 white ball, 1 blue ball and 1 red ball. The prizes given to the participants are as shown below.

Balls drawn	Prize	Value of each prize
2 white	a pack of candies	$5
2 blue	a comic book	$15
2 red	a pair of socks	$10
Others	no prize	—

(a) Let *W*, *B* and *R* stand for a white, a blue and a red ball respectively. Write down the possible outcomes in the following table.

		Bag *B*		
Bag *A*				

(3 marks)

(b) Find the probabilities of drawing

(i) 2 white balls,

(ii) 2 blue balls,

(iii) 2 red balls.

(4 marks)

(c) If David has to pay $5 for playing the lucky draw once, is the lucky draw favourable to him? Explain your answer.

(3 marks)

39. Ivan wants to save money to buy a camera after 3 years. The present price of the camera is \$18 000 and its price is decreased by 10% each year. Two savings plans are offered as follows:

Bank A : An interest rate of 2.5% p.a. compounded yearly.

Bank B : The interest is compounded half-yearly. The interest rate is 2% p.a. for the first year. For each subsequent year, the interest rate increases by 1% p.a..

(a) Find the price of the camera after 3 years.

(3 marks)

(b) (i) Ivan deposits \$10 000 in the bank for 3 years, find the amounts obtained in Bank A and Bank B respectively.

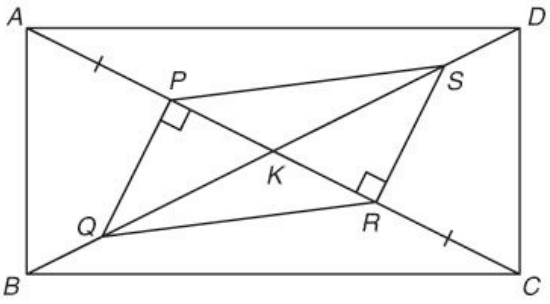
(ii) In which bank should Ivan deposit the money in order to get more interest?

(4 marks)

(c) Hence, find the minimum amount that Ivan should deposit so that he can buy the camera after 3 years, correct to the nearest dollar.

(3 marks)

40. In the figure, $ABCD$ is a rectangle. The diagonals AC and BD intersect at K. $AP = CR$, $QP \perp AK$ and $SR \perp KC$.



(a) Prove that $\triangle QPK \cong \triangle SRK$. (4 marks)

(b) Prove that $\triangle KPS \cong \triangle KRQ$. (4 marks)

(c) By using the results of (a) and (b), prove that $PQRS$ is a parallelogram. (2 marks)

End of Paper