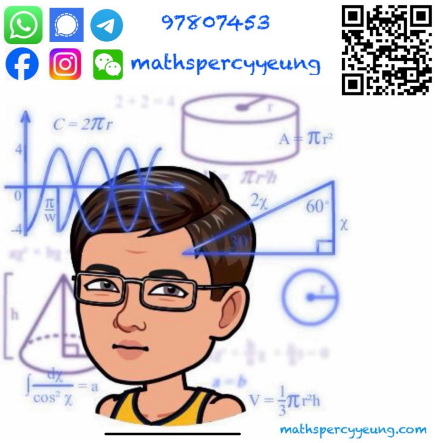
18-19 F.3
2nd TERM EXAM
MATH

2018 – 2019
Form 3 Second Term Examination

MATHEMATICS

Question–Answer Book

5th June, 2019
8:15 am – 10:00 am (1 hour 45 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)	/3
B (32 - 41)	/37
B Total	**/40**
C Total	**/30**
TOTAL	**%**

Section A (30 marks)

Choose the best answer for each question.

1. $2 \times 10^{-4} + 7 \times 10^{-3} =$

   A. 7.2×10^{-3}.
   B. 2.7×10^{-3}.
   C. 7.2×10^{-4}.
   D. 2.7×10^{-4}.

2. Convert the decimal number $16^{10} + 13$ into a hexadecimal number.

   A. $1000000000C_{16}$
   B. $1000000000D_{16}$
   C. $10000000000C_{16}$
   D. $10000000000D_{16}$

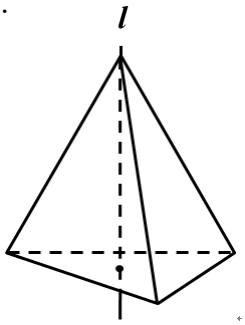
3. $(3 - x)^3 + x^3 =$

   A. 27.
   B. $27 + x^3$.
   C. $3(9 - 3x + x^2)$.
   D. $9(3 - 3x + x^2)$.

4. Factorize $12(x + 1)^2 + 19(x + 1) - 18$.

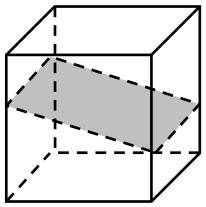
   A. $(3x + 1)(4x + 13)$
   B. $(3x + 1)(4x - 13)$
   C. $(3x - 2)(4x + 9)$
   D. $(3x + 2)(4x - 9)$

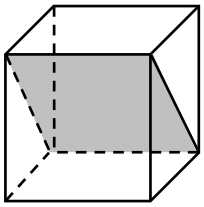
5. The figure shows a regular tetrahedron. When ℓ is the axis of rotation, find the order of its rotational symmetry.

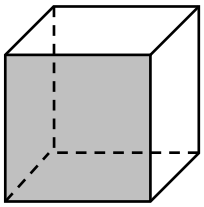


   A. 2
   B. 3
   C. 4
   D. 6

6. Which of the following shaded planes is/are not the plane(s) of reflection of a cube?

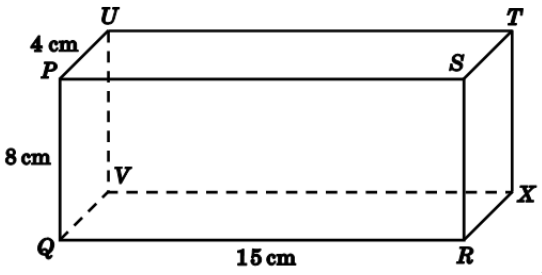
   I.


   II.


   III.


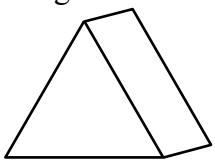
   A. I only
   B. II only
   C. I and III only
   D. I, II and III

7. In the figure, *PQRSTUVX* is a cuboid. Find the distance between the point *T* and the plane *PQVU*.



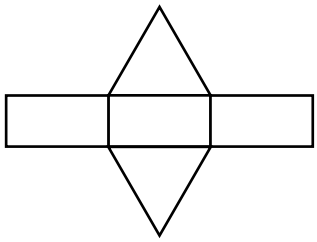
   A. 4 cm
   B. 8 cm
   C. 15 cm
   D. 17 cm

8. Refer to the figure.

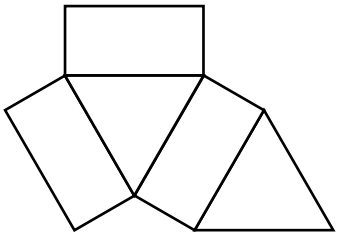


Which of the following nets can be folded into the right triangular prism above?

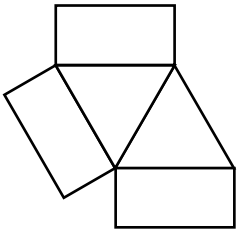
I.



II.

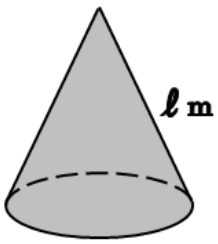


III.



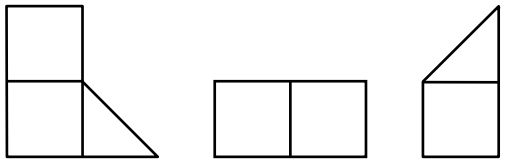
A. I and II only
B. I and III only
C. II and III only
D. I, II and III

9. The figure shows a right circular cone with base area 100π m^2. Its total surface area is 360π m^2. Find ℓ.



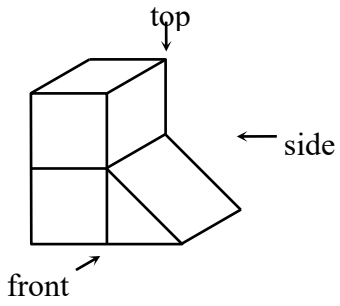
A. 10
B. 24
C. 26
D. 46

10. The following figures shows three 2-D representations of a 3-D object.

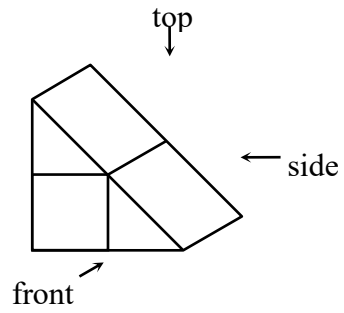


Which of the following is the 3-D object?

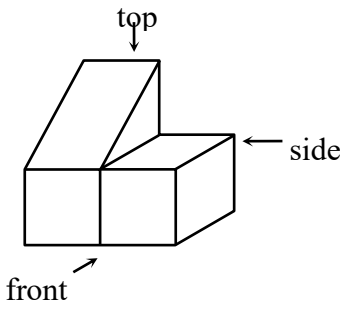
A.



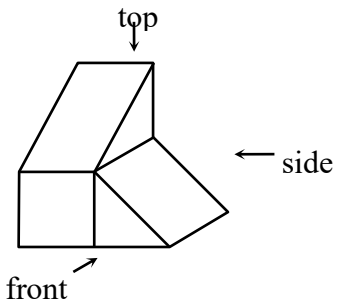
B.



C.



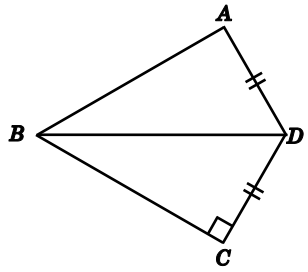
D.



11. The ratio of the total surface areas of two similar prisms A and B are 9 : 4. Find the ratio of the volumes of A and B.

A. 3 : 2
B. 27 : 8
C. 81 : 16
D. 729 : 64

12. Refer to the figure.



If DB is the angle bisector of $\angle ADC$, which of the following must be true?

I. $\angle DAB = 90°$
II. $AB = CB$
III. BD is the angle bisector of $\angle ABC$.

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

13. Which of the following must be true?

A. The in-centre of a triangle is the centre of its inscribed circle.
B. The circumcentre of a triangle lies outside the triangle.
C. The centroid of a triangle is the point of intersection of its three perpendicular bisectors.
D. The orthocentre of a triangle divides each median into two parts in the ratio 2 : 1.

14. In each of the following, the lengths of three line segments are given. Which set(s) of line segments CANNOT form a triangle?

I. 5 cm, 5 cm, 6 cm
II. 4 cm, 8 cm, 12 cm
III. 6 cm, 7 cm, 18 cm

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

15. The stem-and-leaf diagram below shows the distribution of the heights of a group of boys.

Stem (10 cm)	Leaf (1 cm)
15	0 1 2 3
16	5 6 6 8 9
17	2 4 5 7 7 7
18	0 1 6 8 9

A boy is chosen randomly from the group. Find the probability that his height is not more than 177 cm.

A. 0.25
B. 0.4
C. 0.6
D. 0.75

16. The probability that a factory produces a light bulb that does not meet the standard is 0.02. If the factory produces 1 800 light bulbs, estimate the number of light bulbs that meet the standard.

A. 36
B. 360
C. 1 440
D. 1 764

17. The minibuses that May takes every day leave a terminal for every 20 minutes. If she arrives at the terminal at a random time, find the probability that she takes the minibus that leaves the terminal in 5 minutes.

A. $\frac{1}{4}$
B. $\frac{1}{5}$
C. $\frac{1}{15}$
D. $\frac{1}{20}$

18. A sum of \$13 000 is borrowed from a bank at an interest rate of 12% p.a. compounded monthly. Find the interest to be paid after 5 years.

A. \$7 800
B. \$9 910, *cor. to the nearest dollar*
C. \$10 617, *cor. to the nearest dollar*
D. \$23 617, *cor. to the nearest dollar*

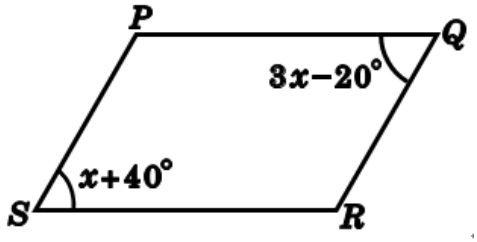
19. The salaries tax rates are shown in the table below:

Net chargeable income	Rate
On the first \$35 000	2%
On the next \$35 000	6%
On the next \$35 000	14%
Remainder	20%

The net chargeable income of Mr. Lee is \$114 000. Find his salaries tax payable.

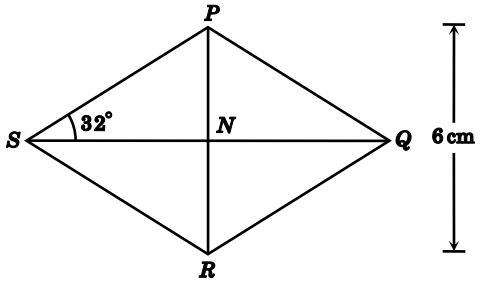
A. \$8 000
B. \$8 500
C. \$9 000
D. \$9 500

20. In the figure, *PQRS* is a parallelogram. Find *x*.



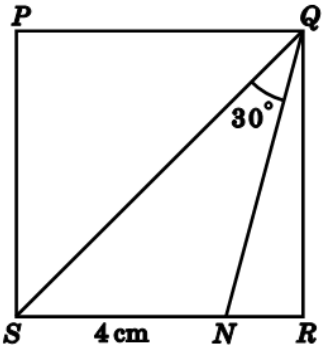
A. 15°
B. 30°
C. 55°
D. 70°

21. In the figure, *PQRS* is a rhombus. *PR* and *QS* intersect at *N*. If *PR* = 6 cm and $\angle PSN = 32°$, find *PS*, correct to 3 significant figures.



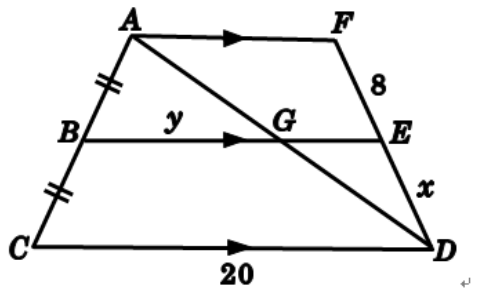
A. 1.58 cm
B. 3.54 cm
C. 5.66 cm
D. 11.32 cm

22. In the figure, *PQRS* is a square. *N* is a point on *SR* such that $\angle NQS = 30°$ and *SN* = 4 cm. Find the area of *PQRS*, correct to the nearest cm^2.



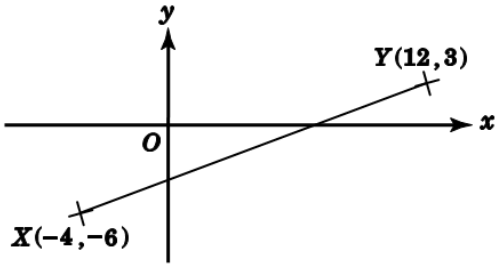
A. 16 cm^2
B. 23 cm^2
C. 30 cm^2
D. 48 cm^2

23. In the figure, B and E are points on AC and DF respectively such that $AB = BC$ and $AF \parallel BE \parallel CD$. It is known that AD and BE intersect at G. Find x and y.



A. $x = 8, y = 10$
B. $x = 8, y = 20$
C. $x = 4, y = 10$
D. $x = 4, y = 20$

24. Find the inclination of the straight line XY in the figure correct to the nearest 0.1°.



A. 20.6°
B. 29.4°
C. 60.6°
D. 69.4°

25. A car travels 3 km due west from R, then travels 12 km due north, and finally travels 19 km due east to S. Find the whole circle bearing of R from S, correct to the nearest degree.

A. 037°
B. 217°
C. 233°
D. 241°

26. Consider a set of data a, b, c, d and e. Their mean is x. If each datum is multiplied by 2 and then subtracted by 3, then the new mean is

A. $2x - 3$.
B. $x - 3$.
C. x.
D. $2x$.

27. The mean weight of 40 rabbits and 80 dogs is 5.2 kg. If the mean weight of these 40 rabbits is 3.6 kg, find the mean weight of these 80 dogs.

A. 1.6 kg
B. 4.4 kg
C. 6 kg
D. 6.2 kg

28. The lengths of eight sticks are 24 cm, 29 cm, 26 cm, 30 cm, 27 cm, 85 cm, 24 cm and 28 cm. Which of the following averages is/are suitable to reflect the central tendency of this set of data?

I. Mean
II. Median
III. Mode

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

29. Consider the following data:

15	13	6	22	11
22	40	35	22	

Which of the following must be true?

I. The lower quartile is 12.
II. The median is 22.
III. The upper quartile is 35.

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

30. The weight of John is 50 kg, correct to the nearest kg. Which of the following is possible to be the actual weight of John?

A. 49.3 kg
B. 49.5 kg
C. 50.5 kg
D. 50.8 kg

Section B (40 marks)

31. Make y the subject of the formula $2x+1=\frac{5-2y}{3}$. (3 marks)

32. Simplify $\frac{(a^{-2})^3 b^2}{(a^5 b^{-1})^2}$ and express your answer with positive indices. (3 marks)

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

Outcome	1	2	3	4	5	6
Frequency	17	k	18	23	19	15

(a) Find the value of k.

(b) Find the experimental probability of getting a prime number. (3 marks)

34. Factorize

(a) $4x^3 - 12x^2y$.

(b) $4x^3 - 12x^2y - xy^2 + 3y^3$.

(4 marks)

35. (a) Solve the inequality $\frac{3x-11}{5} \leq 2x-5$ and represent the solutions graphically.

(b) If x is an integer, write down the smallest value of x.

(4 marks)

36. The population of a country in 2020 will be 1 370 536 875. If the population of the country increased steadily at a rate of 0.57% per year from 2010 to 2020, find the population in 2010 correct to 3 significant figures and express the answer in scientific notation. (3 marks)

37. An examination consists of three parts. The table below shows the marks scored by Grace and Zoe in each part of the examination and the corresponding weights.

	Part I	*Part II*	*Part III*
Grace	68	70	90
Zoe	83	62	58
Weight	4	x	1

It is given that the weighted mean mark of Grace is 71.5.

(a) Find the value of x.

(b) Who performs better in the examination? Explain your answer. (4 marks)

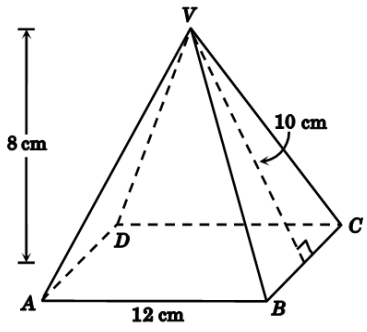
38. Simplify $\cos^2\theta\,[1+\tan^2(90°-\theta)]$ (4 marks)

39. The figure shows a right pyramid $VABCD$ whose base is a square. Find

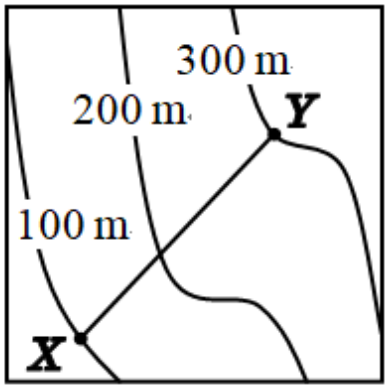
(a) its volume,

(b) its total surface area.

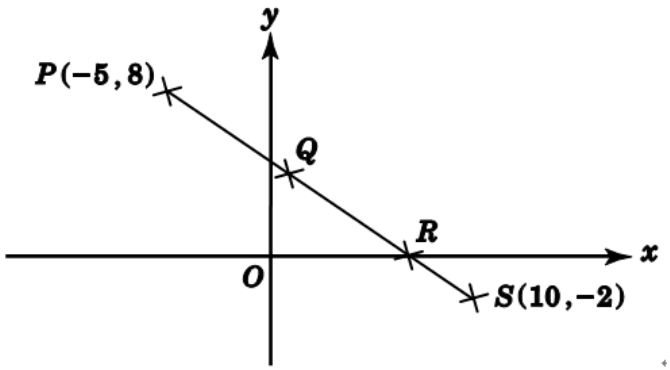
(4 marks)



40. The figure shows a contour map, where XY represents a straight road. If the gradient of the road is $\frac{1}{6}$, find the actual length of XY, correct to 3 significant figures. (3 marks)

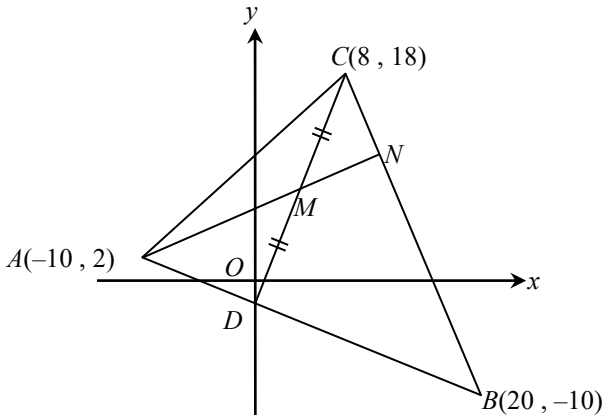


41. In the figure, $PQRS$ is a line segment.
If $PQ : QS = 2 : 3$, find
(a) the coordinates of Q,
(b) $QR : RS$.
(5 marks)



Section C (30 marks)

42. In the figure, the three vertices of a triangle are $A(-10 , 2)$, $B(20 , -10)$ and $C(8 , 18)$.



(a) Find the slope of AB. (2 marks)

(b) AB cuts the y-axis at point D. Find the coordinates of point D. (3 marks)

(c) (i) Find the coordinates of the mid-point M of CD. (2 marks)

(ii) Polly extends AM to N such that AM intersects BC at point N. She claims that AMN is an altitude of $\triangle ABC$. Do you agree? Explain your answer. (3 marks)

43. Figure I shows a solid consisting of a right circular cone P and a hemisphere Q with a common base. Figure II shows a sector AOB. If it is folded into a circular cone, it will cover the cone P of the solid exactly.

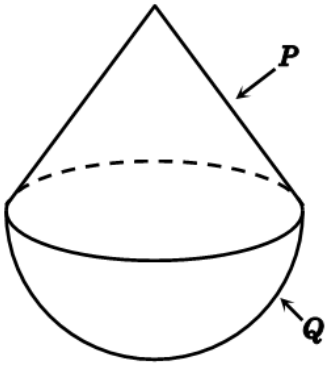


Figure I

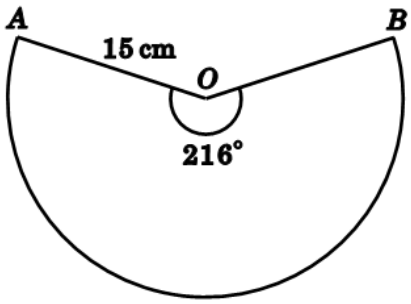


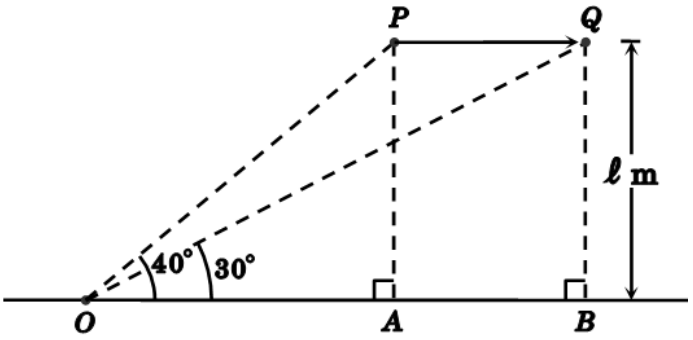
Figure II

(a) Find the base radius of the cone P. (3 marks)

(b) Find the volume of the whole solid in terms of π. (4 marks)

(c) Another solid consists of a right circular cone R and a hemisphere S with a common base. The slant height of the cone R is 10 cm and the area of the circular plane of the hemisphere S is 64π cm^2. Is this solid similar to the solid in Figure I? Explain your answer. (3 marks)

44. In the figure, Roy flies a kite at O on the horizontal ground. When the kite is at P, the angle of elevation of the kite from O is 40°. When the kite reaches Q due east of P, the angle of elevation of the kite from O is 30°. It is given that P and Q are both ℓ m above the ground, and OQ is 20 m longer than OP.



(a) Express the lengths of OP and OQ in terms of ℓ. (2 marks)

(b) Hence, find ℓ, correct to 1 decimal place. (3 marks)

(c) Suppose the kite string is broken, and it continues to fly 30 m from Q in the same direction to R at the same height as Q.

(i) Find the angle of elevation of R from O, correct to 1 decimal place. (3 marks)

(ii) If a building of 40 m tall lies 90 m due east of O, does it block Roy's view of the kite from O? Explain your answer. (2 marks)

End of Paper