END OF YEAR EXAMINATION 2018

THIRD YEAR MATHEMATICS

DURATION: 1 Hour and Forty-Five Minutes

GENERAL INSTRUCTIONS TO CANDIDATES

1) **ALL QUESTIONS ARE TO BE ANSWERED ON THIS QUESTION PAPER. THERE ARE TWO EXTRA PAGES AT THE END OF THIS PAPER FOR ADDITIONAL WORKING.**

2) This Examination Paper consists of **TEN** printed pages.

3) All **TWENTY-TWO** questions are to be attempted.

4) Number your responses carefully and identically (including any associated parts) as they appear on the question paper.

5) Calculators are **ALLOWED**.

6) If a numerical answer cannot be given **exactly**, and the accuracy required is not specified in the question, then in the case of an angle it must be given correct to **one (1)** decimal place, in other cases it **must** be given correct to **three (3) significant figures**.

7) The maximum mark for this Examination is **80**.

8) Write your **NAME** and **FORM** below.

NAME OF STUDENT: _____

FORM: _____

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

LIST OF FORMULAE

Volume of Prism $\qquad$ $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of Cylinder $\qquad$ $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid $\quad$ $V = \dfrac{1}{3} Ah$ where A is the area of the base and h is the perpendicular height.

Circumference $\qquad$ $C = 2\pi r$ where r is the radius of the circle.

Arc length $\qquad$ $S = \dfrac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.

Area of a circle $\qquad$ $A = \pi r^2$ where r is the radius of the circle.

Area of a sector $\qquad$ $A = \dfrac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.

Area of Trapezium $\qquad$ $A = \dfrac{1}{2}(a + b)h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.
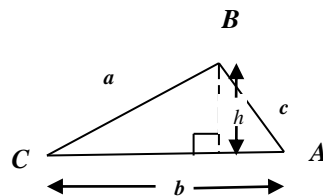
Trigonometric ratios $\quad$ $\sin \theta = \dfrac{opposite\ \ side}{hypotenuse}$

$\qquad\qquad\qquad\qquad$ $\cos \theta = \dfrac{adjacent\ \ side}{hypotenuse}$

$\qquad\qquad\qquad\qquad$ $\tan \theta = \dfrac{opposite\ \ side}{adjacent\ \ side}$
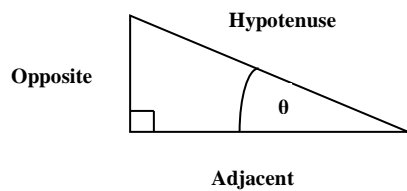
Area of a triangle $\qquad$ Area of $\Delta = \dfrac{1}{2} bh$ where b is the length of the base and h is the perpendicular height.

$\qquad\qquad\qquad\qquad$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

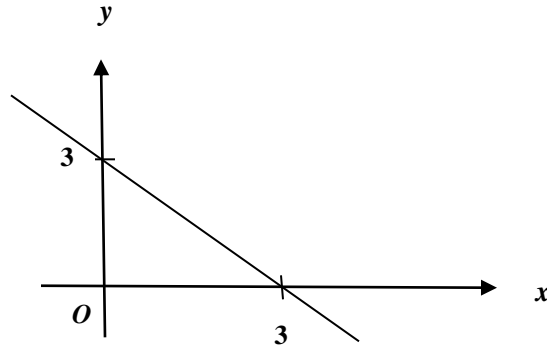$\qquad\qquad\qquad\qquad$ where $s = \dfrac{a+b+c}{2}$

CIRCLE the LETTER that matches your response for Questions 1) to 10).

1) If $x * y$ is defined to be $2x - 5y$, then $3 * a$

(A) $6 - 5a$ (B) $6x - 5a$ (C) $6x - 5y$ (D) $9 + 5a$

2)

The diagram above illustrates the graph of

(A) $y = x + 3$ (B) $y = 3x + 2$ (C) $y = 3$ (D) $y = -x + 3$

3) The gradient of the line perpendicular to $2x - 3y = 1$ is

(A) $\frac{2}{3}$ (B) $-\frac{1}{3}$ (C) $-\frac{3}{2}$ (D) $\frac{1}{2}$

4) If $\frac{4}{x+5} = 4$, then the value of $\frac{1}{x+6}$ is

(A) $\frac{1}{10}$ (B) $-\frac{1}{4}$ (C) $-\frac{1}{2}$ (D) $\frac{1}{2}$

5) A number, $2x$, is decreased by 3 and the result squared. Algebraically, this may be represented as

(A) $2x^2 - 3$ (B) $(2x - 3)^2$ (C) $2x - 3^2$ (D) $2x^2 - 3^2$

6) If $\frac{2}{p} + \frac{1}{q} = r$, then r equals

(A) $\frac{3}{pq}$ (B) $p + 2q$ (C) $\frac{p + 2q}{pq}$ (D) $\frac{2p + q}{pq}$

Questions 7), 8) and 9) refer to the numbers below which represent the weights, in kg, of six picture frames.

$$10, 20, 43, 30, 10, 10$$

7) The modal weight of the picture frames is

(A) 10   (B) 20   (C) 30   (D) 43
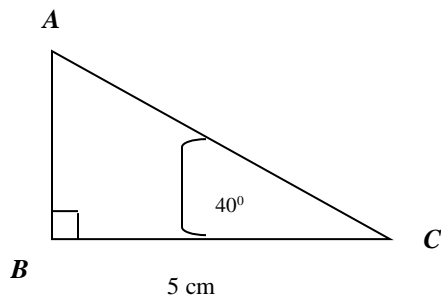
8) The median weight of the picture frames is

(A) 10   (B) 15   (C) 20   (D) 30

9) The mean weight of the picture frames is

(A) 10.0   (B) 20.5   (C) 36.5   (D) 43.0

3

10)

The triangle **ABC** above is right-angled at **B**. Angle **ACB** = 40^0 and **BC** = 5 cm.

The length of **AC**, in cm, is

(A) $5 \tan 40^0$ (B) $\dfrac{5}{\cos 40^0}$ (C) $\dfrac{5}{\sin 40^0}$ (D) $\dfrac{5}{\tan 40^0}$

[Total: **10**]

All working MUST be clearly shown for Questions 11 – 22 in the space provided after each Question

11) A truck is bought for \$ 80 000. It depreciates in value at the rate of 2 % per annum. Calculate

(i) the amount of depreciation after one year.   [2]

(ii) the value of the truck after three years.   [3]

12) Simplify fully $\left(a^{\frac{1}{3}}\right)^{2} \times a^{3}$.   [2]

13) b is directly proportional to the positive square root of c, and $b = 5$ when $c = 9$.

Calculate

(i) the value of the constant of proportionality **[2]**

(ii) the value of b when $c = \frac{1}{4}$. **[2]**

14) Make p the subject of $y = \frac{p}{1-p}$. **[4]**

15) Solve for x and y, the simultaneous equations: $\begin{array}{l} 3x - 4y = 11 \\ 5x + 9y = -13 \end{array}$ [5]

16) (i) Find the equation of the straight line passing through the points $(-2, 5)$ and $(4, -7)$. [3]

  (ii) Determine the equation of the line passing through $(2, 6)$ which is parallel to the line in (i). [3]

17) Steve is married with two children in school. In the year 2017, he earned a gross income of $ 40 000.

Tax-Free Allowances per year
Personal Allowance: $ 15 000
Each School-age Child: $500
Tax Rates
First $2 000 of taxable income: 4 %
Next $3 000 of taxable income: 6 %
Remainder: 8 %

Using the information in the table above, calculate

(i)   his total tax-free allowances   **[3]**

(ii) his taxable income   **[2]**

(iii) the amount of income tax paid   **[4]**

(iv) his net income.   **[2]**

18) Customers visiting a business were surveyed. The results are shown in the table below.

| Age	Male	Female
Under 30	30	25
30 and over	40	5

(i) If one customer is chosen at random, calculate the probability that the customer is female. **[3]**
(ii) Calculate the probability that a randomly chosen customer will be under 30 given that
the customer is male.   **[3]**

19) The height of a sample of cadet recruits were recorded and shown in the table below.

Height (cm)	Number of recruits
120 – 124	2
125 – 129	6
130 – 134	17
135 – 139	15
140 – 144	10

(i)   State the modal class. **[1]**

(ii) Calculate the mean height of the recruits. **[7]**

(iii) Determine the probability that a recruit chosen at random is not more than 134 cm. **[2]**

20)
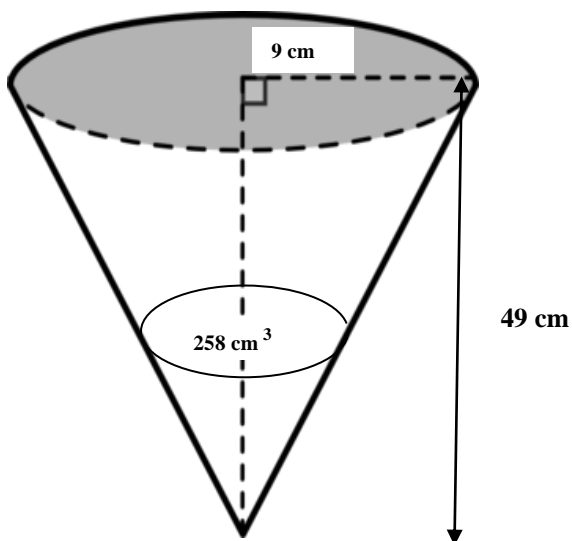
A right, circular cone of base radius 9 cm and height 49 cm is inverted and partially filled

with 258 cm³ of water. Use $\pi = \frac{22}{7}$

(i) Calculate EXACTLY, the capacity of the cone. **[2]**

(ii) If water is now poured into the container at the rate of 20 cm³s⁻¹, calculate the time taken

to completely fill the cone. **[3]**

21)
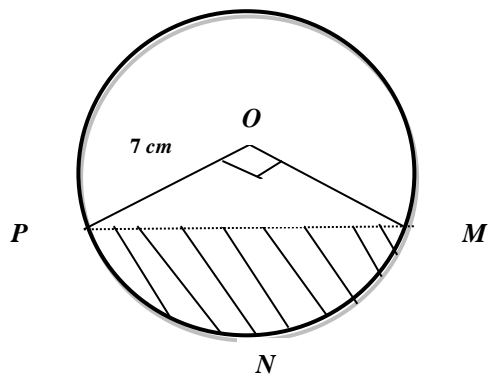
In the diagram above, **not drawn to scale**, O is the centre of the circle of radius

7 cm and $\angle POM = 90^0$. Taking $\pi = \dfrac{22}{7}$, calculate <u>EXACTLY</u>

(i) the area of triangle *POM*.   **[2]**

(ii) the shaded area.   **[2]**

22) A person standing at a point *A* on top of a cliff *AB* which is 50 metres high, can see a

buoy, *L*, in the water whose angle of depression is 20^0.

(i) Sketch a <u>fully labelled</u> diagram to show <u>ALL</u> of the above information.   **[5]**

(ii) Calculate an estimate of the distance of the buoy from the foot of the cliff.   **[3]**

End of Examination

EXTRA PAGE FOR WORKING

EXTRA PAGE FOR WORKING