NAME:
STREAM: $\qquad$ HOUSE:


## KING'S COLLEGE, BUDO

## DEPARTMENT OF MATHEMATICS

## EXERCISE 1

## Instructions:

- Attempt all the questions.
- Acceleration due to gravity, $g=9.8 \mathrm{~ms}^{-2}$

1. In the table below, is part of an extract of $\tan x^{0}$.

| $\mathrm{X}=40^{\circ}$ | $6 /$ | $12 /$ | $18 /$ | $24 /$ | $30 /$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\tan \mathrm{x}$ | 0.8421 | 0.8451 | 0.8481 | 0.8511 | 0.8541 |

Use linear interpolation or extrapolation to estimate the;
(i) value of $\sec 40^{\circ} 20^{\prime}$
(ii) angle whose tangent is 0.8555 .
2. A drawer contains 8 brown socks and 4 blue socks. A sock is taken from the drawer at random, its colour is noted and it is then replaced. This procedure is performed twice more. If $X$ is the r.v. "the number of brown socks taken", find the probability distribution of $X$. Hence find $E(X)$ and $\operatorname{Var}(X)$.
3. Forces of magnitude $4,6,8,3$ and 5 N act on a particle in the directions of $320^{\circ}, 280^{\circ}$, $220^{\circ}, 160^{\circ}$ and $060^{\circ}$ respectively. Find the magnitude of the resultant force acting on the particle.
4. A box contains five black balls, 6 yellow balls and 9 green balls. Two balls are picked without replacement. Find the probability that the two balls are (i) black and yellow, (ii) of the same colour.
5. Two forces have magnitudes $P$ and $q$ and the angle between them is $\theta$. If the resultant of these two forces has magnitude $R$, and makes an angle $\alpha$ with the force $P$, show that:
(a) $R^{2}=P^{2}+Q^{2}+2 P Q \cos \theta$,
(b) $\tan \alpha=\frac{Q \sin \theta}{P+Q \cos \theta}$. If $\mathrm{P}=\mathrm{Q}$ and $\theta=40^{\circ}$, find $\alpha$.
6. The resultant of two forces $P$ and $Q$ is of magnitude $R$ newtons and acts an angle $\theta$ to the direction of $P$. Find $R$ and $\theta$, given that the magnitudes of $P$ and $Q$ and the angle between their directions is $12 \mathrm{~N}, 5 \mathrm{~N} ; 90^{\circ}$ respectively.
7. A set of observations has got $m$ zeros and $n$ ones. (i) Find the mean of this set. (ii) Show $\underline{\sqrt{m n}}$ that the standard deviation $\square$ for this set is $\square \square$.

$$
m \square n
$$

8. Seven army recruits (A, B, C,........,G) were given two separate aptitude tests. Their orders of merit in each test were.

| Order of merit | $1_{\text {st }}$ | 2nd $^{\text {n }}$ | $3_{\text {rd }}$ | $4_{\text {th }}$ | $5_{\text {th }}$ | 6th | 7th |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Ist $^{\text {st }}$ test | G | F | A | D | B | C | E |
| $2^{\text {nd }}$ test | D | F | E | B | G | C | A |

Compute Spearman's coefficient of rank correlation between the performances in the two tests. Comment on your results.
9. The continuous random variable $X$ has p.d.f. $f(x)$ where

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D, (b) $F(x)$ and sketch $y=F(x)$, (c) $P(2 \square X \square 3.5)$, (d) $P(X \square$
Find (a) $\square$ and
5.5), (e) $E(X)$.
10. A vertical pole of height 24 m is held in position by three straight wires fixed to its top and to points on the horizontal ground. The wires are of lengths $25 \mathrm{~m}, 30 \mathrm{~m}$ and 26 m and their fixing points are at bearings $060^{\circ}, 150^{\circ}$ and $270^{\circ}$ respectively from the base of the pole. If the tensions in the wires are each 50N, find (a) the vertical components of the tensions, (b) the horizontal components of the tensions. Hence find (c) the resultant force downwards caused by the wires, (d) the resultant horizontal force on the pole.
11. The table below shows the cumulative distribution of the age (in years) of 400 students of a girls'secondary school.

| Age (in years) | Cumulative frequency |
| :---: | :---: |
| $<12$ | 0 |
| $<13$ | 27 |
| $<14$ | 85 |
| $<15$ | 215 |
| $<16$ | 370 |
| $<17$ | 395 |
| $<18$ | 400 |
| $<19$ |  |

Plot an ogive for the data and use it to estimate:
(i) median age,
(j) $20^{\text {th }}$ to $80^{\text {th }}$ percentile age range.

