Year 12 Methods Unit 3,4
Test 3 2021

Section 1 Calculator Free
DRV, Trigonometry, Growth & Decay, Rectilinear Motion

STUDENT'S NAME ____

DATE: Thursday 13 May **TIME:** 20 minutes **MARKS**: 23

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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1. (7 marks)

The following table shows a discrete probability distribution for random variable X. The expected value of X is 2.

x	0	1	2	3	4
P(X = x)	a	a + b	0.2	0.3	0.1

(a) Determine the value of a and b [3]

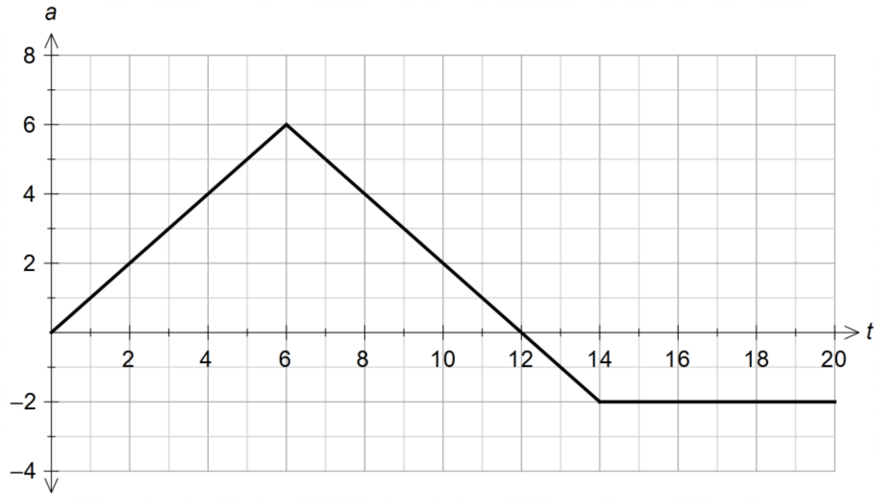
(b) It is known that the standard deviation of X is 0.6 and for the random variable Y, Y = -2(X + 5). Determine

(i) E(Y) [2]

(ii) SD(Y) [2]

2. (8 marks)

A particle, initially at rest at the origin, moves subject to an acceleration, a ms^{-2}, as shown in the graph below for $0 \le t \le 20$ seconds.



(a) Determine the velocity of the particle when

(i) t = 6 [1]

(ii) t = 20 [2]

(b) At what time is the velocity of the particle a maximum, and what is the maximum velocity? [2]

(c) Determine the distance of the particle from the origin after 3 seconds. [3]

3. (5 marks)

(a) Differentiate $7x\sin(3x)$ with respect to x. [2]

(b) Hence determine $\int x\cos(3x)dx$ [3]

4. (3 marks)

For a \$5 monthly fee, a TV repair company guarantees customers a complete service. The company estimates the probability that a customer will require one service call in a month as 0.05, the probability of two service calls as 0.01 and the probability of three or more calls as 0.00. Each call costs the repair company \$40. What is the TV repair company's expected monthly gain from each customer?

Year 12 Methods Unit 3,4
Test 3 2021

Section 1 Calculator Assumed
DRV, Trigonometry, Growth & Decay, Rectilinear Motion

STUDENT'S NAME ______________________________

DATE: Wednesday 31st March **TIME: 30** minutes **MARKS**: 32

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser
Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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5. (8 marks)

From the analysis of median house price (M) in a city on July 1 each year from 2001 to 2019, it was determined that $\frac{dM}{dt} = 0.0746M$, where t is the time in years since July 1 2001.

(a) According to this model, how long does it take for house prices to double? [3]

From the data collected, it was observed that the median house price on July 1 2009 was $430 000.

(b) Determine the instantaneous rate of change of the median house price at this time. [1]

(c) What was the median house price July 1 2018? [2]

(d) When did the median house price reach $500 000? [2]

6. (12 marks)

Analysis of the number of dogs registered by each household within a suburb resulted in the following percentages.

Number of dogs registered	0	1	2	3 or more
Percentage of households	21	44	27	8

(a) A council worker selects households at random to visit. What is the probability that the first five households visited all have at least one dog registered? [2]

(b) A random sample of 40 households within the suburb is selected. Use the binomial distribution to determine the probability the sample contains:

(i) exactly 6 households with no registered dogs [2]

(ii) no more than 15 households with at least two registered dogs [2]

(c) A random sample of 25 households within the suburb is to be selected. If the random variable D is the number of households in the sample that have exactly one dog registered, determine E(D) and Var(D). [3]

(d) In a random sample of 50 households, where the random variable Z is the number of households with no registered dogs, determine $P(Z \geq 2 | Z \leq 4)$. [3]

7. (12 marks)

Sam is one of ten members of a social club. Each week one member is selected at random to win a prize.

(a) Define the random variable X for this scenario. [1]

(b) What is the probability Sam has his third win in week 8. [2]

(c) In the first 20 weeks, does Sam have a greater chance of winning exactly 2 prizes or exactly 3 prizes? [3]

(d) For how many weeks does Sam have to participate in the prize draw so that he has a greater chance of winning exactly 3 prizes than of winning 2 prizes? [3]

Note: $\binom{n}{r} = \frac{n!}{r!(n-r)!}$

(d) For how many weeks must Sam participate so that the probability he wins at least once is at least 0.9? [3]