



Student Name MARKING KEY

**Eastern Goldfields College
Mathematics Applications 2016**

Test 6 (U2 T3) – Calculator Free

Total Marks: 28 marks

Time allowed: 30 minutes

No calculator or notes permitted for this section.

Answer all of the following questions. Show all working to obtain full marks.

Question 1 (5 marks: 1, 2, 2)

- 1) The random variable X is normally distributed with a mean of 45g and a standard deviation of 4g.

- a) Determine $P(X < 41)$.

$$\begin{aligned} & 50\% - 34\% \\ & = 16\% \quad \checkmark \end{aligned}$$

- b) Given $P(45 - x < X < 45 + x) = 0.997$, find the value of x .

$$45 - x = 45 - (\sigma \times 3)$$

$$x = 3\sigma \quad \sigma = 4g \quad \checkmark$$

$$x = 12g \quad \checkmark$$

- c) Determine the quantile when the mass is 49g.

$$49g \Rightarrow \bar{X} + \sigma$$

$$= 50 + 34$$

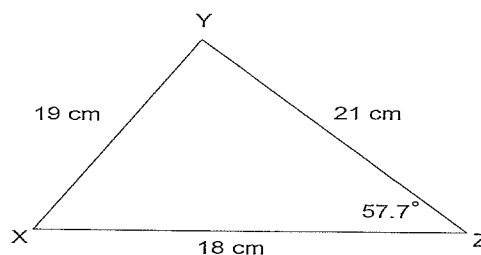
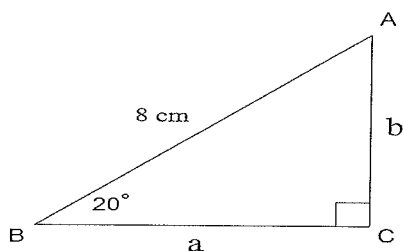
$$= 84\% \quad \checkmark$$

$$= 0.84$$

$\therefore 49g$ ~~is~~ is the 0.84 quantile \checkmark

Question 2 (4 marks)

The diagram below shows two triangles: $\triangle ABC$ is a right triangle and $\triangle XYZ$ is a non-right triangle. The diagram is not drawn to scale.



Consider the six statements (A, B, C, D, E and F) that follow. Two of the statements are correct, but four of these statements contain an error.

For each incorrect statement rewrite the statement to make it correct.

Statement A

$$a^2 - b^2 = 64$$

ERROR

$$a^2 + b^2 = 64$$

Statement B

$$\tan 70^\circ = \frac{a}{b}$$

CORRECT

Statement C

$\angle Y$ is the largest angle in $\triangle XYZ$

ERROR

$\angle X$ is the largest angle in $\triangle XYZ$.

Statement D

$$\text{Area } \triangle XYZ = \frac{1}{2} \times 18 \times 19 \times \sin 57.7^\circ$$

ERROR

$$\text{Area } \triangle XYZ = \frac{1}{2} \times 18 \times 21 \times \sin 57.7^\circ$$

Statement E

$$\cos X = \frac{19^2 + 18^2 - 21^2}{2 \times 19 \times 18}$$

CORRECT

Statement F

$$\sin 20^\circ = \frac{8}{b}$$

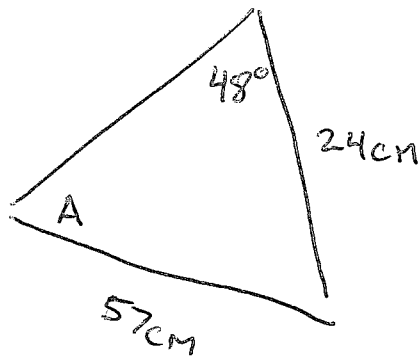
ERROR

$$\sin 20^\circ = \frac{b}{8}$$

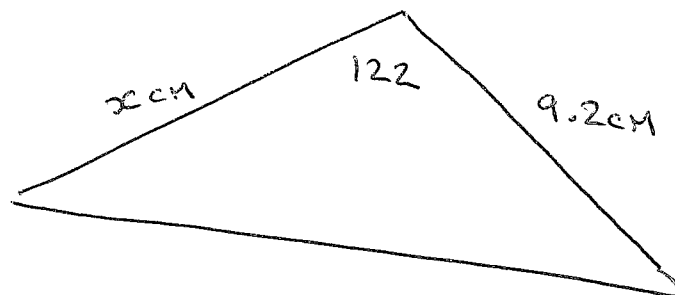
Question 3 (3 marks: 1, 1, 1)

For each of the following, draw the triangle that corresponds with the given information:

(a) $\frac{\sin A}{24\text{cm}} = \frac{\sin 48^\circ}{57\text{cm}}$



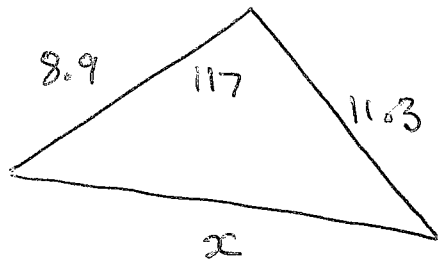
(b) $x = 2 \left(\frac{25\text{cm}^2}{9.2\text{cm} \times \sin 122^\circ} \right)$



Must be obtuse.



(c) $x = \sqrt{8.9^2 + 11.3^2 - 2(8.9)(11.3)\cos 117^\circ}$



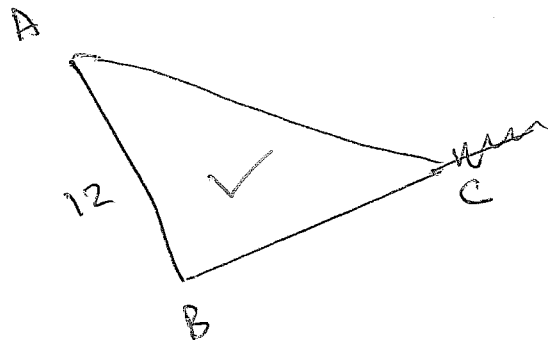
Must be obtuse.



Question 4 (6 marks: 3, 3)

(a) In triangle ABC , $AB = 12$ cm, $\sin B = 0.3$ and $\sin C = 0.2$.

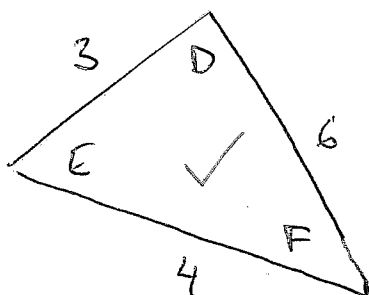
Determine the length of side AC .



$$\frac{12}{0.2} = \frac{AC}{0.3} \quad \checkmark$$

$$AC = 18 \text{ cm} \quad \checkmark$$

(b) In triangle DEF , $d = 4$ cm, $e = 6$ cm and $f = 3$ cm. Determine the value of $\cos F$.



$$\cos F = \frac{d^2 + e^2 - f^2}{2 \times d \times e}$$

$$\cos F = \frac{4^2 + 6^2 - 3^2}{2 \times 4 \times 6} \quad \checkmark$$

$$= \frac{43}{48} \quad \checkmark$$

Question 5 (4 marks)

Solve the following pair of simultaneous equations:

$$2x + 3y = 1$$

$$x - y = 18$$

$$2x - 2y = 36$$

✓ working

✓ working

$$2(18 + y) + 3y = 1$$

$$36 + 2y + 3y = 1$$

$$5y = -35$$

$$y = -7$$

$$x = 11$$

$$y = 37$$

$$x = 11$$

and

$$y = -7$$

Any method.

$$22 - 21 = 1$$

Question 6 (6 marks: 5, 1)

a) The table below shows data about four different tests. Complete the table below:

Test	Score	Standardised Score	Mean	Standard deviation
1	10	1 ✓	8	2
2	6	-3 ✓	12	2
3	20 ✓	2	15	2.5
4	10	-0.8	12.4 ✓✓	3

b) Order the student's performance in the four tests from best to worst.

Test 3, Test 1, Test 4, Test 2 ✓

**Eastern Goldfields College
Mathematics Applications 2016**

Test 6 (U2 T3) – Calculator Assumed

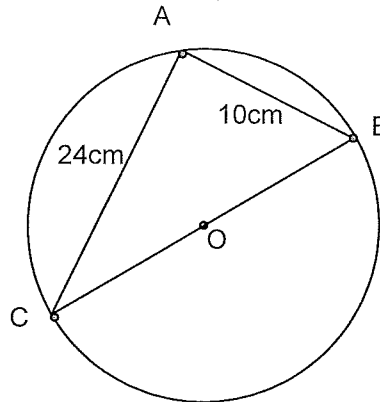
Total Marks: 34 marks

Time allowed: 35 minutes

Answer all of the following questions. Show all working to obtain full marks.

Question 1 (6 marks: 2, 2, 2)

In this diagram, all three vertices of the triangle lie on the circumference of a circle of radius 13cm and the diameter of the circle is the side BC. Side AB is 10cm long and side AC is 24cm.



- (a) Use the cosine rule to show that the size of angle CAB is 90° .

$$\cos(CAB) = \frac{24^2 + 10^2 - (13 \times 2)^2}{2 \times 24 \times 10} \checkmark$$

$$= 90^\circ \checkmark$$

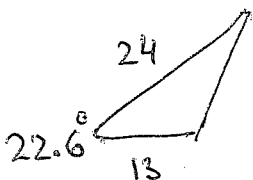
- (b) Calculate the size of angle ACB.

$$\tan(ACB) = \frac{10}{24} \checkmark$$

$$ACB = \tan^{-1}\left(\frac{10}{24}\right)$$

$$= 22.6^\circ \text{ (1 dp)} \checkmark$$

- (c) Draw a line from O to A on the diagram above and then find the area of triangle AOC.



$$A = \frac{1}{2} \times 13 \times 24 \times \sin 22.6 \checkmark$$

$$= 59.95 \text{ cm}^2 \text{ (2 dp)} \checkmark$$

Question 2 (10 marks: 2 each)

Suppose a factory produces Freddo frogs, and they are normally distributed with a mean mass of 35g and a standard deviation of 2g.

- a) What is the probability that a Freddo has a mass of less than 38.5g?

$$P(X < 38.5) = 0.96 \quad (2dp)$$

✓✓

- b) If the probability of a Freddo being greater than a mass of q is 0.8, find q

$$P(X > q) = 0.8$$

$$q = 33.3g \quad (1dp) \quad ✓✓$$

0.25% of all the Freddo's produced are discarded because they are underweight.

- c) What is the lightest mass (to the nearest g) a Freddo can be before being discarded?

$$P(X < k) = 0.0025$$

✓✓

$$k = 29.4g \quad (1dp) \quad ✓✓$$

- d) If 2.5 million Freddo's are produced per day, how many are of the correct mass and can be sold each day (assume exactly 0.25% are underweight)?

$$100 - 0.25 = 99.75\% \quad ✓$$

$$0.9975 \times 2500000$$

$$= 2493750 \quad ✓$$

- e) The mass of a giant Freddo is normally distributed, with a standard deviation of 3g. If the probability of the mass being less than 42.5g is 0.8, what is the mean weight of a giant Freddo?

$$P(X < 42.5) = 0.8$$

$$\bar{x} = 39.98g \quad (2dp) \quad ✓✓$$

Question 3 [6 marks: 2, 4]

Ben and Holly each buy tickets for themselves and their families for the elf concert. Ben buys two child's tickets and four adult tickets and he pays \$24. Holly buys three children's tickets and three adult tickets and she spends \$21.

a) Write two equations in terms of, c , the price of a child's ticket and, a , the price of an adult ticket, for what each Ben and Holly spent.

$$2c + 4a = 24 \quad \checkmark$$

$$3c + 3a = 21 \quad \checkmark$$

where

c = child's ticket cost in \$

a = adult ticket cost in \$.

$$\text{Case } \Rightarrow 2c = 24 - 4a$$

$$c = 12 - 2a$$

$$3(12 - 2a) + 3a = 21$$

$$36 - 6a + 3a = 21$$

$$36 - 3a = 21$$

$$-3a = -15$$

$$a = 5$$

b) Solve your equations to determine the cost of each type of ticket.

Show full alg. using

$$a = \$5 \quad \checkmark \checkmark$$

$$c = \$2 \quad \checkmark \checkmark$$

(any method).

$$2c + 4a = 24$$

$$3c + 3a = 21$$

$$\Rightarrow 2c = 24 - 4a$$

$$c = 12 - 2a$$

$$3(12 - 2a) + 3a = 21$$

$$36 - 6a + 3a = 21$$

$$36 - 3a = 21$$

$$15 = 3a \quad \checkmark \checkmark$$

$$5 = a$$

$$c = 12 - 2(5)$$

$$c = 2$$

$$\text{adult} = \$5 \quad \checkmark$$

$$\text{child} = \$2 \quad \checkmark$$

$$6c + 12a = 72 \quad \textcircled{1} \quad \checkmark$$

$$6c + 6a = 42 \quad \textcircled{2}$$

$$6a = 30 \quad \textcircled{1} - \textcircled{2}$$

$$a = 5 \quad \checkmark$$

$$6c + 60 = 72$$

$$6c = 12$$

$$c = 2 \quad \checkmark$$

\therefore child ticket \$2 ✓
adult " \$5 ✓

Question 4 (4 marks: 2, 2)

Use the graph on the right, to solve the following linear equations:

a) $y = -\frac{1}{2}x + 2$ and $y = \frac{1}{2}x + 4$

$(-2, 3)$

$x = -2$ ✓

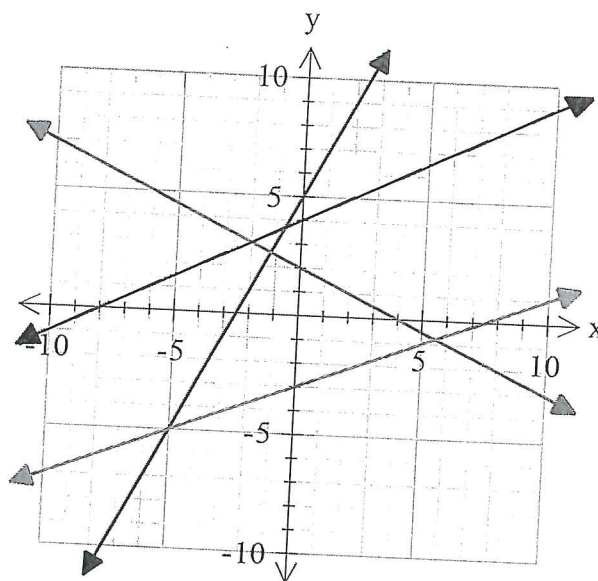
$y = 3$ ✓

b) $5y = 2x - 15$ and $y = 2x + 5$

$(-5, -5)$

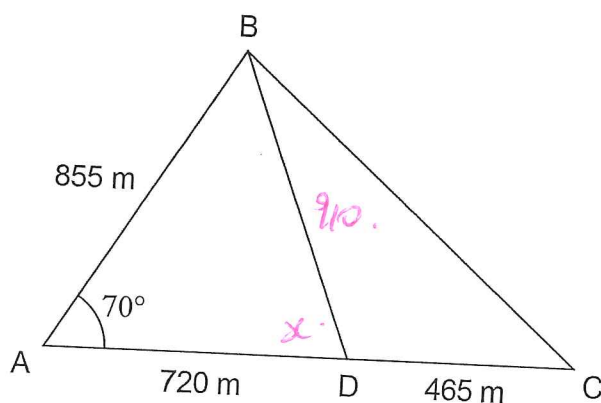
$x = -5$ ✓

$y = -5$ ✓



Question 5 (8 marks: 2, 2, 4)

A small plantation of pine trees is bounded by the three sides of triangle ABC shown below. A road runs through the plantation from B to D. The distances AB, AD and DC are 855, 720 and 465 metres respectively and angle BAD is 70° .



- (a) Use trigonometry to determine the length of the road from B to D, rounding your answer to the nearest metre.

$$BD^2 = 855^2 + 720^2 - 2 \times 855 \times 720 \times \cos 70^\circ \checkmark$$

$\approx 910 \text{ m}^2 \checkmark$

-1 if not rounded.

- (b) Use trigonometry to determine the size of the acute angle ADB, the angle between the road and the southern edge of the plantation.

$$\frac{910}{\sin 70} = \frac{855}{\sin(\text{ADB})} \quad \checkmark$$

$$\text{ADB} = 62^\circ \quad (0 \text{ dp}) \quad \checkmark$$

$$855^2 = 720^2 + 910^2 - 2(720)(910)\cos\theta$$

$$\theta = 61.98 \approx 62^\circ$$

- (c) The plantation requires spraying with an insecticide at a cost of 2.8 cents per square metre. Determine the cost of spraying the whole of plantation ABC.

$$A = \frac{1}{2} \times 855 \times (720 + 1185) \times \sin 70 \quad \checkmark$$

$$= 476036.54 \text{ m}^2 \quad (2 \text{ dp}) \quad \checkmark$$

$$\times 0.028$$

$$= \$13329.02 \quad \checkmark \checkmark$$