

2022 MGS A Math Preliminary Exam P2 Answer Key

1 (ii) $-\frac{8\pi}{5}$ radians/sec or -5.03 rad/s

2 (ii) 0.528 or $2 - \frac{4}{e}$

3 (a) -4320
(b) (i) $1 + 8ax + 28a^2x^2 + \dots$
(ii) $a = 2, b = 25$

4 (i) let $\angle CAD = x$,
 $\angle CAD = \angle ABC = x$ (Tangent-Chord Theorem)
 $\angle ADH = \angle CDH = y$ (KD bisects $\angle ADC$)

(ii) $\frac{HD}{KD} = \frac{AD}{BD}$ ($\triangle AHD$ and $\triangle BKD$ are similar)

$$HD \times BD = KD \times AD$$

(iii)
 $\angle AHD = 180^\circ - x - y$ (angle sum of triangle)
 $\angle AHK = x + y$ (supp angle) - M1

$\angle BKD = 180^\circ - x - y$ (angle sum of triangle) - M1
 $\angle AHK = x + y$ (supp angle)

since $\angle AHK = \angle AKH$, $\triangle AHK$ is isosceles. - A1

5 (b) $x = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}$

6 $\frac{7x+4}{(x-2)(x^2+5)} = \frac{2}{x-2} + \frac{3-2x}{x^2+5}$

7 (a) $2\left(x - \frac{3}{2}\right)^2 + \frac{5}{2}$, since the minimum point is $(1.5, 2.5)$, the graph lies above $y = 2$.

(b) $x = 6561$ or $x = \frac{1}{9}$

(c) $x = 4, y = 1$

8 (b) (i) $y = -\frac{2}{3}x + 6$ (eqn CE), $5y = x - 9$ (eqn DA)

(ii) $E(9, 0)$, $DA : AE = 1 : 2$

(b) $BCDE$ is a trapezium. BC is parallel to DE and $BC \neq DE$

(c) 78 units^2

- 9 (i) $y = \frac{1}{2}x - \frac{1}{4}$ or $4y = 2x - 1$
(ii) 2.20
- 10 (ii) $P = 19 + \sqrt{386} \cos(\theta - 14.7^\circ)$
(iii) $\max P = 38.6$ cm when $\theta = 14.7^\circ$
(iv) $\theta = 63.3^\circ$
- 11 (ii) $p = 1.52$, $k = 765$
(iii) no. of weeks = 4.95
(iv) The model is based on exponential increase and the number of insects cannot increase indefinitely. In 5 years, it will have 4.40×10^{18} insects, which is impractical.

