答案和解析

1.【答案】B

2.【答案】D

【解答】

解：在$Rt\triangle ABC$中，$\angle ACB=90^{\circ}$，$BC=1$，$AB=2$，

$\therefore AC=\sqrt{AB^2-BC^2}=\sqrt{3}$，

$\therefore sinA=\frac{BC}{AB}=\frac{1}{2}$，$tanA=\frac{BC}{AC}=\frac{\sqrt{3}}{3}$，$cosB=\frac{BC}{AB}=\frac{1}{2}$，$tanB=\frac{AC}{BC}=\sqrt{3}$.

故选D.

3.【答案】D

【解答】解：在$Rt\triangle PAB$中，

$\because \angle APB=30^{\circ}$，

$\therefore PB=2AB$，

由题意知$BC=2AB$，

$\therefore PB=BC$，

$\therefore \angle C=\angle CPB$，

$\because \angle ABP=\angle C+\angle CPB=60^{\circ}$，

$\therefore \angle C=30^{\circ}$，$\therefore PC=2PA$，

$\because PA=AB\cdot \tan 60^{\circ}$，

$\therefore PC=2\times 20\times \sqrt{3}=40\sqrt{3}$(海里).

故选D.

4.【答案】D

5.【答案】A

【解答】

解：$\because$四边形$ABCD$是矩形，

$\therefore AD=BC$，$AD//BC$，

∵点E是边BC的中点，

$\therefore BE=\frac{1}{2}BC=\frac{1}{2}AD$，

$\therefore\triangle BEF\backsim\triangle DAF$，

$\therefore\frac{EF}{AF}=\frac{BE}{AD}=\frac{1}{2}$，

$\therefore EF=\frac{1}{2}AF$，

$\therefore EF=\frac{1}{3}AE$，

∵点E是边BC的中点，

∴由矩形的对称性得：$AE=DE$，

$\therefore EF=\frac{1}{3}DE$，设$EF=x$，则$DE=3x$，

$\therefore DF=\sqrt{DE^2-EF^2}=2\sqrt{2}x$，

$\therefore\tan\angle BDE=\frac{EF}{DF}=\frac{x}{2\sqrt{2}x}=\frac{\sqrt{2}}{4}$;

故选 A.

6.【答案】C

【解析】略

7.【答案】C

【解析】设$EB=1$，则$AE=4$，$BC=\frac{5}{2}$，$AC=\frac{5\sqrt{3}}{2}$.

$\therefore CF=\frac{\sqrt{3}}{2}.\therefore tan\angle CFB=\frac{5\sqrt{3}}{3}$.

8.【答案】$\frac{5}{4}$,

【解析】解：∵$\triangle DBC$和$\triangle ABC$关于直线BC对称，

$\therefore AC=CD$，$AB=BD$，

$\because AB=AC$，

$\therefore AC=CD=AB=BD$，

∴四边形$ABDC$是菱形，

$\therefore AD\perp BC$，$AO=DO=4$，$BO=CO=3$，$\angle ACO=\angle DCO$，

$\therefore BD=\sqrt{DO^2+BO^2}=\sqrt{9+16}=5$，

$\because CE\perp CD$，

$\therefore \angle DCO+\angle ECO=90^\circ=\angle CAO+\angle ACO$，

$\therefore \angle CAO=\angle ECO$，

$\therefore \tan\angle ECO=\frac{EO}{CO}=\frac{CO}{AO}$,

$\therefore \frac{EO}{3}=\frac{3}{4}$,

$\therefore EO=\frac{9}{4}$,

$\therefore AE=\frac{7}{4}$,

$\therefore \frac{2OE+AE}{BD}=\frac{2\times\frac{9}{4}+\frac{7}{4}}{5}=\frac{5}{4}$,

9.【答案】$\frac{3}{4}$

【解析】解：$\because S_{正方形ADEF}=25$，

$\therefore AF=5$，

在$Rt\triangle ABC$中，点F是斜边BC的中点，

$\therefore BC=2AF=10$，

$\because AB=6$，

$\therefore AC=\sqrt{BC^2-AB^2}=\sqrt{10^2-6^2}=8$，

$\therefore tanC=\frac{AB}{AC}=\frac{6}{8}=\frac{3}{4}$,

10.【答案】B

【解析】解：$tanM=\frac{1}{2}$,

$\therefore \frac{DG}{DM}=\frac{1}{2}$,

$\therefore$设$DG=x$，$DM=2x$，

$\therefore GM=\sqrt{DG^2+DM^2}=\sqrt{x^2+(2x)^2}=\sqrt{5}x$，

设$HD = y$，

由题意得：$\triangle AEH \cong \triangle DHG$，

$\therefore AE = HD = y$，$AH = DG = x$，

$tanM = \frac{1}{2}$，

$\therefore \frac{AE}{AM} = \frac{y}{3x+y} = \frac{1}{2}$，

$\therefore 3x + y = 2y$，

$\therefore y = 3x$，

$\therefore DH = y = 3x$，

$\therefore HG = \sqrt{DH^2 + DG^2} = \sqrt{(3x)^2 + x^2} = \sqrt{10}x$，

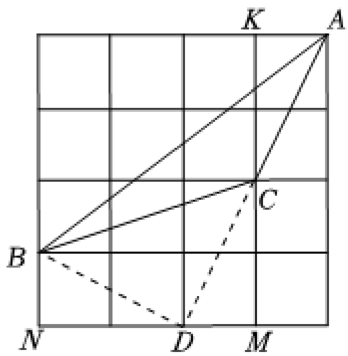
$\therefore \frac{HG}{GM} = \frac{\sqrt{10}x}{\sqrt{5}x} = \sqrt{2}$，

故选：B.

11.【答案】$\frac{\sqrt{2}}{10}$

12.【答案】$(100 + 100\sqrt{3})$

13.【答案】$\frac{1}{2}$



【解析】解：连接BD，CD，

$\because \tan\angle ACK = \tan\angle DCM = \frac{1}{2}$，

$\therefore \angle ACK = \angle DCM$，

$\because \angle DCM + \angle DCK = 180°$，

$\therefore \angle ACK + \angle DCK = 180°$，

$\therefore A$、C、D共线，

$\because CD^2 = BD^2 = 2^2 + 1^2$，$BC^2 = 3^2 + 1^2$，

$\therefore BC^2 = BD^2 + CD^2$，

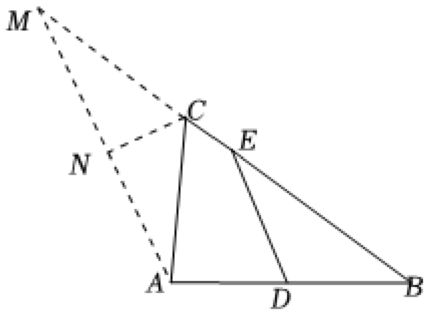
$\therefore \angle BDC = 90°$，

$\because BD = \sqrt{5}$，$AD = \sqrt{4^2 + 2^2} = 2\sqrt{5}$，

$\therefore \tan\angle BAC = \frac{BD}{AD} = \frac{\sqrt{5}}{2\sqrt{5}} = \frac{1}{2}$.

故答案为：$\frac{1}{2}$.

14.【答案】$\sqrt{3}$



【解析】解：延长BC至M，使$CM = CA$，连接AM，作$CN \perp AM$于N，

DE平分$\triangle ABC$的周长，

$\therefore ME = EB$，

$\because AD = DB$，

$\therefore DE = \frac{1}{2}AM$，$DE // AM$，

$\because \angle ACB = 60°$，

$\therefore \angle ACM = 120°$，

$\because CM = CA$，

$\therefore \angle ACN = 60°$，$AN = MN$，

$\therefore AN = AC \cdot \sin\angle ACN = \frac{\sqrt{3}}{2} \times 2 = \sqrt{3}$，

$\therefore AM = 2DE = 2AN = 2\sqrt{3}$，

$\therefore DE = \sqrt{3}$，

故答案为：$\sqrt{3}$.

15.【答案】$\frac{4\sqrt{3}}{3}$ 或 $4\sqrt{3}$ 或 4

16.【答案】$\frac{9}{4}$

【解析】解：如图，过点E作$EH \perp x$轴于H，

$\because$矩形$AOBC$的边OA，OB分别在y轴和x轴上，已知对角线$OC = 5$，$\tan\angle BOC = \frac{3}{4} = \frac{BC}{OB}$，

$\therefore$设$BC = 3x$，$OB = 4x$，

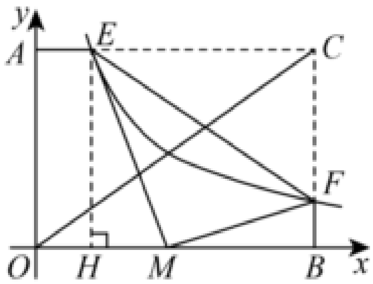
$\therefore (3x)^2+(4x)^2=5^2$，

解得：$x=1$，(负值舍去)

$\therefore BC=3$，$OB=4$，

$\therefore C(4,3)$，

$\because$点E、F在反比例函数$y=\frac{k}{x}(k>0)$的图象上，



$\therefore E(\frac{k}{3},3)$，$F(4,\frac{k}{4})$，

$\therefore CE=4-\frac{k}{3}$，$CF=3-\frac{k}{4}$，

$\because$将$\triangle CEF$沿EF翻折后，点C恰好落在OB上的点M处，

$\therefore EM=CE=4-\frac{k}{3}$，$MF=CF=3-\frac{k}{4}$，$\angle EMF=\angle ECF=90°$，

$\because \angle HEM+\angle EMH=90°$，$\angle BMF+\angle EMH=90°$，

$\therefore \angle HEM=\angle BMF$，

$\because \angle EHM=\angle CBM=90°$，

$\therefore \triangle EHM \backsim \triangle MBF$，

$\therefore \frac{EH}{MB}=\frac{EM}{MF}$，即$\frac{3}{BM}=\frac{4-\frac{k}{3}}{3-\frac{k}{4}}$，

解得：$BM=\frac{9}{4}$.

故答案为：$\frac{9}{4}$.

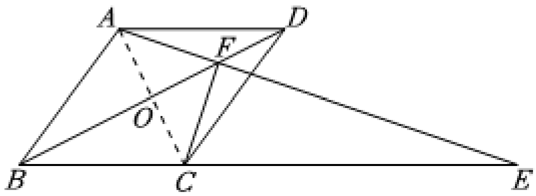
17.【答案】15

【解析】解：连接AO交BD于点O，

$\because$四边形$ABCD$是菱形，$AB=5$，

$\therefore CB=AB=DA=5$，$OA=OC$，$OD=OB$，$AC\perp BD$，

$\therefore \angle ABD = \angle CBD$，$\angle COB = 90°$，



$\therefore \frac{OC}{CB} = \sin\angle CBD = \sin\angle ABD = \frac{\sqrt{5}}{5}$，

$\therefore OA = OC = \frac{\sqrt{5}}{5}CB = \frac{\sqrt{5}}{5} \times 5 = \sqrt{5}$，

$\therefore OD = OB = \sqrt{CB^2 - OC^2} = \sqrt{5^2 - (\sqrt{5})^2} = 2\sqrt{5}$，

$\therefore BD = OB = 4\sqrt{5}$，

$\because CF \perp AE$，

$\therefore \angle CFE = 90°$，则$OF = OC = \frac{1}{2}AC = \sqrt{5}$，

$\therefore BF = OB + OF = 2\sqrt{5} = 3\sqrt{5}$，$DF = OD - OF = 2\sqrt{5} - \sqrt{5} = \sqrt{5}$，

$\because BE // DA$，

$\therefore \triangle BEF \backsim \triangle DAF$，

$\therefore \frac{BE}{DA} = \frac{BF}{DF} = \frac{3\sqrt{5}}{\sqrt{5}} = 3$，

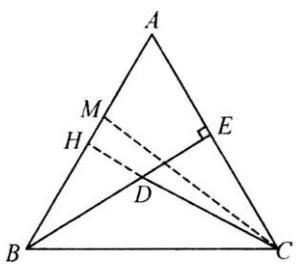
$\therefore BE = 3DA = 3 \times 5 = 15$；

故答案为：15．

18.【答案】$\frac{2}{3}$或$\frac{3}{2}$

19.【答案】$4\sqrt{5}$

【解析】解：过点D，C分别作$DH \perp AB$于点H，$CM \perp AB$于点M．



$\because BE \perp AC$，$\therefore \angle AEB = 90°$，

$\because \tan A = \frac{BE}{AE} = 2$，

设$AE=a$，$BE=2a$，

则有$100=a^2+4a^2$，

$\therefore a^2=20$，

$\therefore a=2\sqrt{5}$或$-2\sqrt{5}$(舍去)，

$\therefore BE=2a=4\sqrt{5}$，

$\because AB=AC$，$BE\perp AC$，$CM\perp AB$，

$\therefore CM=BE=4\sqrt{5}$(等腰三角形两腰上的高相等)，

$\because \angle DBH=\angle ABE$，$\angle BHD=\angle BEA=90°$，

$\therefore \sin\angle DBH=\frac{DH}{BD}=\frac{AE}{AB}=\frac{\sqrt{5}}{5}$，

$\therefore DH=\frac{\sqrt{5}}{5}BD$，$\therefore CD+\frac{\sqrt{5}}{5}BD=CD+DH$，

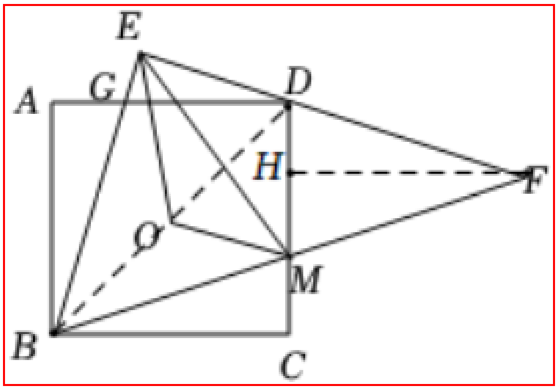
$\because CD+DH\geq CM$，$\therefore CD+\frac{\sqrt{5}}{5}BD\geq 4\sqrt{5}$，

$\therefore CD+\frac{\sqrt{5}}{5}BD$的最小值为$4\sqrt{5}$.

20.【答案】$2\sqrt{5}$

【解答】

解：如图，连接BD，过点F作$FH\perp CD$于点H.



$\because$四边形$ABCD$是正方形，

$\therefore AB=AD=3\sqrt{2}$，$\angle A=\angle ADC=90°$，

$\because \tan\angle ABG=\frac{AG}{AB}=\frac{1}{3}$，

$\therefore AG=\sqrt{2}$，$DG=2\sqrt{2}$，

$\therefore BG=\sqrt{AB^2+AG^2}=\sqrt{(3\sqrt{2})^2+(\sqrt{2})^2}=2\sqrt{5}$，

$\because \angle BAG=\angle DEG=90°$，$\angle AGB=\angle DGE$，

$\therefore \triangle BAG\backsim\triangle DEG$，

$\therefore \frac{BA}{DE}=\frac{AG}{EG}=\frac{BG}{DG}$，$\angle ABG=\angle EDG$，

$\therefore \frac{3\sqrt{2}}{DE}=\frac{\sqrt{2}}{EG}=\frac{2\sqrt{5}}{2\sqrt{2}}$，

$\therefore DE=\frac{6\sqrt{5}}{5}$，$EG=\frac{2\sqrt{5}}{5}$，

$\therefore BE=BG+EG=2\sqrt{5}+\frac{2\sqrt{5}}{5}=\frac{12\sqrt{5}}{5}$，

$\because \angle ADH=\angle FHD=90°$，

$\therefore AD//FH$，

$\therefore \angle EDG=\angle DFH$，

$\therefore \angle ABG=\angle DFH$，

$\because BG=DF=2\sqrt{5}$，$\angle A=\angle FHD=90°$，

$\therefore \triangle BAG\cong\triangle FHD(AAS)$，

$\therefore AB=FH$，

$\because AB=BC$，

$\therefore FH=BC$，

$\because \angle C=\angle FHM=90°$，

$\therefore FH//CB$，

$\therefore \frac{FM}{BM}=\frac{FH}{CB}=1$，

$\therefore FM=BM$，

$\because EF=DE+DF=\frac{6\sqrt{5}}{5}+2\sqrt{5}=\frac{16\sqrt{5}}{5}$，

$\therefore BF=\sqrt{BE^2+EF^2}=4\sqrt{5}$，

$\because \angle BEF=90°$，$BM=MF$，

$\therefore EM=\dfrac{1}{2}BF=2\sqrt{5}$

故答案为：$2\sqrt{5}$.

21.【答案】解：(1)原式$=3\times\frac{\sqrt{3}}{3}-\frac{1}{\frac{1}{2}}+2\sqrt{2}\times\frac{\sqrt{2}}{2}+\sqrt{(1-\sqrt{3})^2}$

$=\sqrt{3}-2+2+(\sqrt{3}-1)$

$=2\sqrt{3}-1$；

(2)解：原式$=(\sqrt{3})^2+\frac{\sqrt{3}}{3}+2\times\frac{\sqrt{3}}{3}-(\frac{\sqrt{2}}{2})^2$

$=3+\dfrac{\sqrt{3}}{3}+\dfrac{2\sqrt{3}}{3}-\dfrac{1}{2}$

$=\frac{5}{2}+\sqrt{3}$.

22.【答案】 解：(1)原式$=1-2\times\frac{\sqrt{3}}{2}+\sqrt{3}-1+2$

$=2$.

(2)解：原式$=\sin^2 23°+\cos^2 23°+2\times\frac{\sqrt{3}}{2}+1-\sqrt{3}$

$=1+\sqrt{3}+1-\sqrt{3}$

$=2$.

23.【答案】解：(1)原式$=\frac{\frac{\sqrt{3}}{2}-1}{\sqrt{3}-2\times1}-\sqrt{3}\times\frac{\sqrt{3}}{2}+\sqrt{2}\times\frac{\sqrt{2}}{2}$

$=\dfrac{\dfrac{\sqrt{3}-2}{2}(\sqrt{3}+2)}{(\sqrt{3}+2)(\sqrt{3}-2)}-\sqrt{3}\times\dfrac{\sqrt{3}}{2}+\sqrt{2}\times\dfrac{\sqrt{2}}{2}$

$=\dfrac{1}{2}-\dfrac{3}{2}+1$

$=0$.

(2)原式$=2\sqrt{2}+2-4\times\frac{\sqrt{2}}{2}-2\times2\times2-1$

$=2\sqrt{2}+2-2\sqrt{2}-8-1$

$=-7$.

24． $\frac{3}{5}$

25.【答案】解：(1) $\because AD$是BC边上的高，

$\therefore AD\perp BC$.

在$Rt\triangle ABD$中，

$\because \sin B=\frac{AD}{AB}=\frac{1}{3}$，$AD=1$，

$\therefore AB=3$，

$\therefore BD=\sqrt{3^2-1^2}=2\sqrt{2}$

在$Rt\triangle ADC$中，$\because \angle C=45°$，$\therefore CD=AD=1$.

$\therefore BC=BD+CD=2\sqrt{2}+1$.

(2) $\because AE$是BC边上的中线，

$\therefore DE=CE-CD=\frac{1}{2}BC-CD=\frac{2\sqrt{2}+1}{2}-1=\sqrt{2}-\frac{1}{2}$.

在$Rt\triangle ADE$中，$tan\angle DAE=\frac{DE}{AD}=\frac{\sqrt{2}-\frac{1}{2}}{1}=\sqrt{2}-\frac{1}{2}$.

26.【答案】解：由题意知$AB=24$米，$\angle BDA=53°$，

$\therefore \tan\angle BDA=\frac{AB}{AD}=\frac{24}{AD}\approx 1.33$.

$\therefore AD\approx\frac{24}{1.33}\approx 18.05$(米).

$\because \tan\angle CAD=\frac{CD}{AD}=\frac{CD}{18.05}$，$\angle CAD=30°$，

$\therefore CD\approx 18.05\times\tan 30°=18.05\times\frac{\sqrt{3}}{3}\approx 10.4$(米).

答：办公楼的高度约为10.4米.

27.【答案】【小题1】

在$Rt\triangle ABC$中，$AC=8$，$BC=6$，由勾股定理，得$AB=\sqrt{AC^2+BC^2}=10$.所以$\cos A=\frac{AC}{AB}=\frac{4}{5}$.又$AE=5$，$ED\perp AB$，所以$AD=AE\cdot\cos A=4$.则$AD=4$.

【小题2】

在边AC上截取$CF=BC=6$，连接BF.因为$\angle C=60°$，所以$\triangle BCF$是等边三角形．所以$BF=BC=CF=6$，$\angle BFC=60°$.又$AC=14$，所以$AF=AC-CF=8$，$\angle AFB=180°-\angle BFC=120°$.又$\angle EDB=60°$，所以$\angle ADE=180°-\angle EDB=120°$，即$\angle ADE=\angle AFB$.又$\angle A=\angle A$，所以$\triangle ADE\backsim\triangle AFB$.所以$\frac{AD}{AF}=\frac{DE}{FB}$.又$DE=2$，所以$\frac{AD}{AF}=\frac{1}{3}$，即$AD=\frac{1}{3}AF=\frac{8}{3}$.

【小题3】

在边AC上截取$CG=BC=50\ m$，连接BG.因为$AC=150\ m$，所以$AG=AC-CG=100\ m$.因为$\angle C=90°$，所以$\triangle BCG$为等腰直角三角形．在$Rt\triangle BCG$中，由勾股定理，得$BG=\sqrt{BC^2+CG^2}=50\sqrt{2}m$.同(2)，得$\triangle ADE\backsim\triangle AGB$.所以$\frac{AD}{AG}=\frac{DE}{GB}$.又$DE=20\sqrt{2}m$，所以$\frac{AD}{AG}=\frac{2}{5}$，即$AD=\frac{2}{5}AG=40m$.则$A$，$D$两点之间的距离为$40\ m$.

28.【答案】解：(1)猜想AF与DM的数量关系是$AF=2DM$，

理由：∵四边形$ABCD$是正方形，

$\therefore CD=AD$，$\angle ADC=90°$，

在$\triangle ADF$和$\triangle CDE$中，$\begin{cases}AD=CD\\ \angle ADF=\angle CDE\\ DF=DE\end{cases}$，

$\therefore\triangle ADF\cong\triangle CDE(SAS)$，

$\therefore AF=CE$，

$\because M$是CE的中点，

$\therefore CE=2DM$，

$\therefore AF=2DM$，

故答案为：$AF=2DM$；

(2)①$AF=2DM$仍然成立，

理由如下：延长DM到点N，使$MN=DM$，连接CN，

$\because M$是CE中点，

$\therefore CM=EM$，

又$\angle CMN=\angle EMD$，

$\therefore\triangle MNC\cong\triangle MDE(SAS)$，

$\therefore CN=DE=DF$，$\angle MNC=\angle MDE$，

$\therefore CN//DE$，

又$AD//BC$

$\therefore\angle NCB=\angle EDA$，

$\because$四边形$ABCD$是正方形，

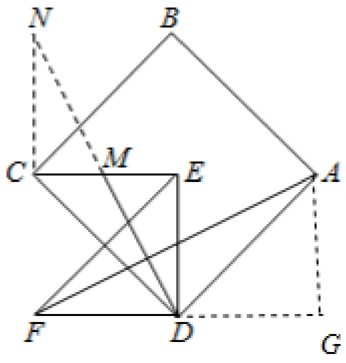
$\therefore AD=DC$，$\angle BCD=90°=\angle EDF$，

$\therefore\angle ADF=\angle DCN$，

$\therefore\triangle ADF\cong\triangle DCN(SAS)$，

$\therefore AF=DN$，

$\therefore AF=2DM$；



②$\because\triangle ADF\cong\triangle DCN$，

$\therefore\angle NDC=\angle FAD$，

$\because\angle CDA=90°$，

$\therefore\angle NDC+\angle NDA=90°$，

$\therefore\angle FAD+\angle NDA=90°$，

$\therefore AF\perp DM$；

③$\because\alpha=45°$，

$\therefore\angle EDC=90°-45°=45°$

$\because\angle EDM=2\angle MDC$，

$\therefore\angle EDM=\frac{2}{3}\angle EDC=30°$，

$\therefore\angle AFD=30°$，

过A点作$AG \perp FD$的延长线于G点，$\therefore \angle ADG = 90° - 45° = 45°$，

$\therefore \triangle ADG$是等腰直角三角形，

设$AG = k$，则$DG = k$，$AD = AG \div sin45° = \sqrt{2}k$，

$FG = AG \div tan30° = \sqrt{3}k$，

$\therefore FD = ED = \sqrt{3}k - k$，

故$\frac{AD}{ED} = \frac{\sqrt{2}k}{\sqrt{3}k-k} = \frac{\sqrt{6}+\sqrt{2}}{2}$.